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SELECTED CONTENTS

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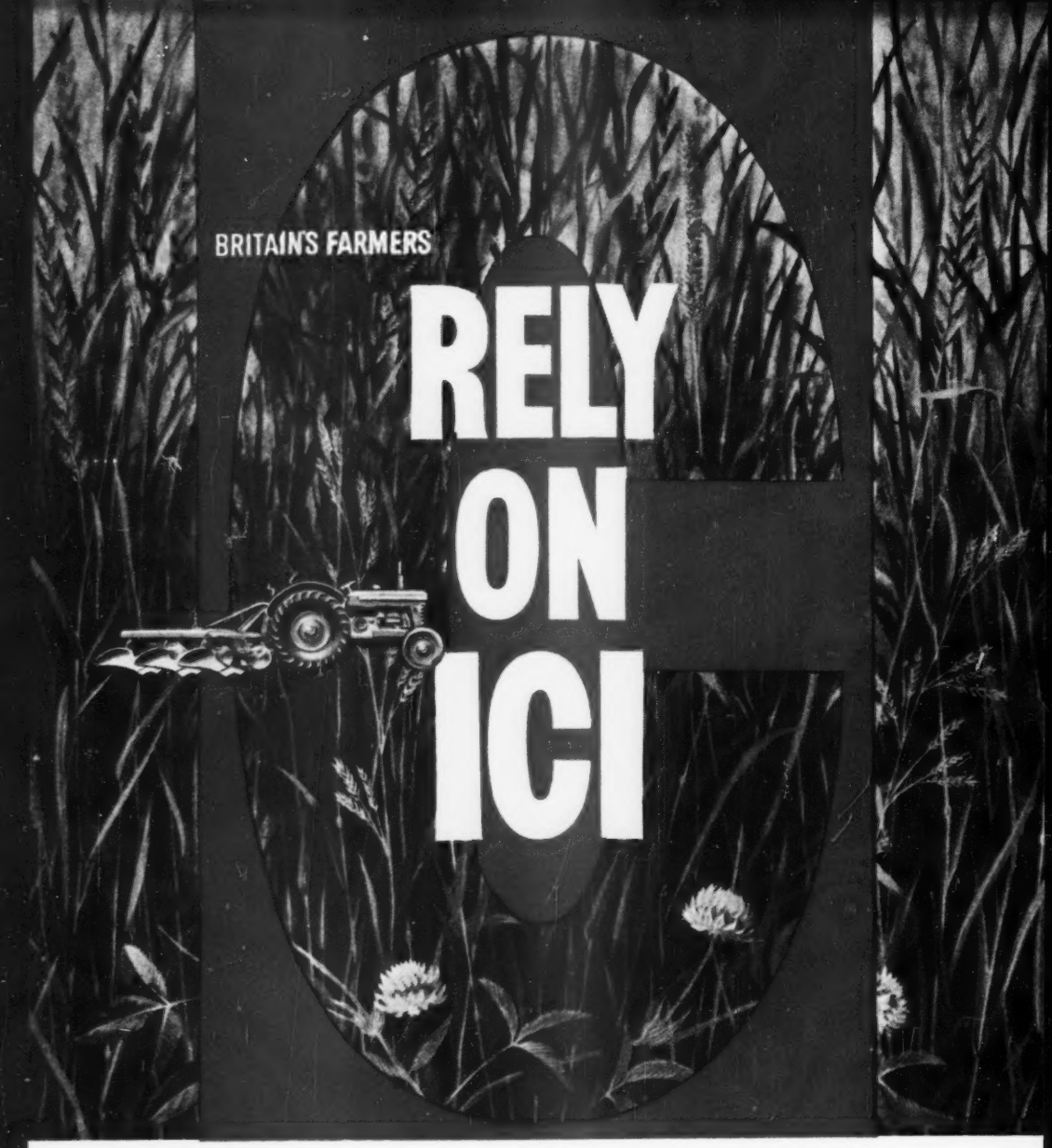

"Studies made by University agricultural economists, with no axes to grind and no ulterior motive in singing the praises of particular farm practices, are showing that additional expenditure on fertilizers usually yields a higher return than spending money in any other direction on the farm." **FARMING FOR PROFITS** *by Keith Dexter & Derek Barber (Penguin Books)*

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Agriculture

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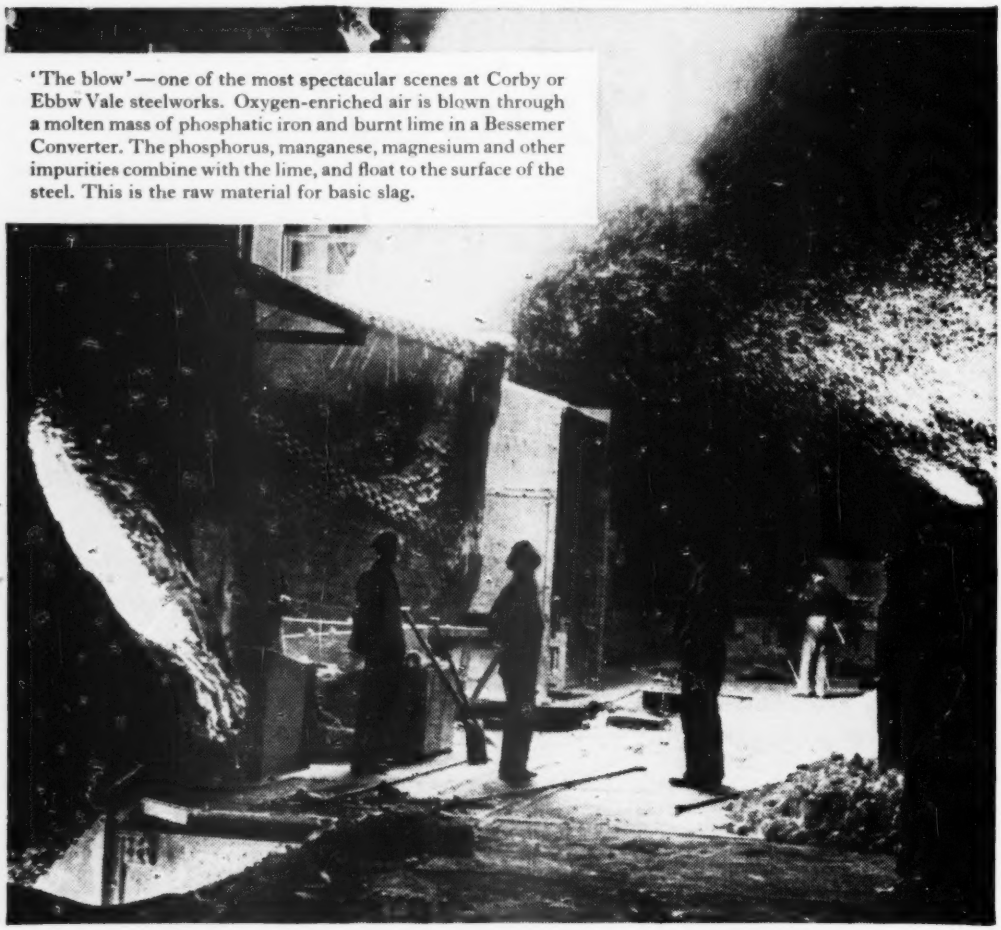

'The blow'—one of the most spectacular scenes at Corby or Ebbw Vale steelworks. Oxygen-enriched air is blown through a molten mass of phosphatic iron and burnt lime in a Bessemer Converter. The phosphorus, manganese, magnesium and other impurities combine with the lime, and float to the surface of the steel. This is the raw material for basic slag.

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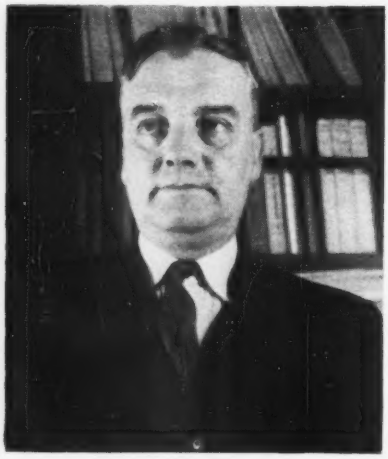
Literature from Chief Agricultural Adviser, Fisons Basic Slag Ltd., Harvest House, Ipswich, Suffolk or any Fisons Sales Office

LAMB CARE

THE milk supplied by their dams is the only food for these lambs until they are about six weeks old. After this the level of milk supply decides how much each lamb must rely on grass for its growth. Where the supply is low, the leafiness or otherwise of the grass is the next limiting factor. Clean, young and leafy pasture which has not carried sheep for the past twelve months provides good nutrition and minimizes losses from parasitic infestations. Twins, which rely more on grass for their food, have a greater chance of eating worm eggs than singles. The full benefits of intensive creep grazing systems are, therefore, more likely to be realized in flocks with high lambing percentages.

From May to August watch should be kept for blowfly strike; the blowflies being most active when the weather is damp and sultry and the fleeces moist or soiled by scouring. Modern dips have greatly reduced the effects of "strikes", but there is usually a period just before shearing when extra vigilance pays.



The Prospects of

Eradicating Animal Diseases

SIR JOHN RITCHIE

IN dealing with the control of diseases of animals it is probably always worth while to start by considering whether the disease could possibly be eradicated. This may be setting the sights fairly high. Only one disease, vesicular exanthema, has been completely eliminated. This disease was confined to pigs, closely resembled foot-and-mouth disease in its symptoms, but was caused by a distinct virus. It was declared eradicated from the U.S.A. in October, 1959, and, since it has never been recorded elsewhere, this claim may have world-wide application.

However, many animal diseases have been cleared from Britain and from other countries. Rinderpest, contagious bovine pleuro-pneumonia, rabies, parasitic mange of horses and sheep scab have disappeared. All these show well-marked and definite symptoms and were confined more or less to single species. It has been possible to keep the country free of these diseases, even though it may have meant very strict measures controlling the importation of animals and animal products.

Many difficulties interfere with complete eradication. The main ones are described in this article.

Difficult territory and methods of husbandry

Contagious bovine pleuro-pneumonia was eliminated from Britain in 1898. There was little precise knowledge of the disease; even its cause was only discovered by French workers in the same year. Our predecessors based their controls on their observations in the field. Much more is known now. Tests to confirm diagnosis, and vaccines are available. It is not a disease which spreads rapidly but it is still present in a number of countries, for example, in some parts of Australia, where the conditions of climate and territory make it almost impossible so to control the animals that tests or vaccines can be applied to them.

Parasitic mange is not an important disease in many countries nowadays, but sheep scab is still a problem in those areas where it has been found difficult to round up sheep for regular dipping and to control the movement of animals sufficiently well.

The pattern of the poultry industry greatly complicates the control of disease. Carcasses in deep-freeze may carry over infections such as fowl pest.

Infection in wild species

Rinderpest is even now one of the great killer diseases of cattle. Excellent vaccines can be applied to its control, but it is extremely difficult to eradicate. Pigs, which are not normally affected by the virus, play a part in its dissemination, and wild herbivores may be a reservoir of virus which spills over to susceptible domestic species.

Rabies is also a disease which is perpetuated by wild species. In North America, for example, foxes and wolves are important. Such animals as the mongoose and the skunk may also become involved. The virus does not necessarily prove fatal in the skunk, which may therefore be a continuing source of virus infection for animals with which it comes into contact. Bats may carry the virus, and in some countries even fruit-eating bats may be responsible for carrying infection to farm animals and to man.

The wart hog may carry the virus of African swine fever and is capable of spreading infection to the domestic pig unless it is kept under such control that contact with the wart hog is avoided: this is done in Kenya.

In other diseases, such as leptospirosis, African horse sickness, fowl pest and psittacosis, wild species may play a part in the spread of the disease. In the islands of north and west Scotland sea birds were involved in a series of outbreaks of fowl pest.

In many countries wild herbivores serve to maintain a reservoir of foot-and-mouth disease virus. On one occasion we found hedgehogs had become affected during a series of outbreaks in Norfolk. There is no evidence that this infection has been maintained and it can safely be claimed that the virus does not exist in any wild life in Britain.

Danger from imports

We have always succeeded in eliminating foot-and-mouth disease whenever it appears, and it is only because we are in close proximity to Europe and because we have to import material, for instance from South America, that we become reinfected.

We have constantly to guard against the introduction of diseases which have been eliminated from the country and, equally, to prevent the introduction of any which have never appeared here. This is the reason why we have to lay down careful conditions when we import animals from abroad such as Friesians from Holland, Danish Reds from Denmark, Charollais from France, Polled Herefords from Australia and Landrace pigs from Sweden.

Economic factors

In some countries the cattle may show less marked symptoms of disease than those seen in improved European breeds. This may even occur with foot-and-mouth disease or rinderpest. In tropical countries disease may spread less readily than it does in our colder climates. The cost of eradication, or even control, may therefore appear to be disproportionate to the losses unless the presence of infection prevents export of various animal products.

Warble fly could be eradicated by the proper application of dressings to infested cattle. The newer products may change the situation, but because

the losses from this disease do not fall directly on the farmer it is extremely difficult to encourage or enforce the careful attention to dressing or treatment which is necessary.

Eradication based on the results of tests

The eradication of glanders, a disease of horses, depended to a great extent on the mallein test, comparable to the tuberculin test. When it is necessary to resort to tests such as tuberculin or agglutination tests, eradication becomes a long and cumbersome process requiring very detailed organization. Particularly is this so if a disease is well entrenched in a country or in a locality. Nevertheless it is the absence of a good test to discover latent infection that makes it impossible to apply radical methods of control to diseases such as Johne's disease.

In Britain bovine tuberculosis has been brought to the stage when some 15 reactors are found in every 10,000 animals tested. When the campaign started in 1935 some 40 per cent of cows or about 20 per cent of all cattle were reactors to the test, so that in any case it could not have been done more quickly without serious interference with meat and milk supplies.

To maintain the present level of freedom or to improve it, careful, well-organized tuberculin testing must be done throughout the country. Infection is probably maintained in some herds by older animals which, affected with the disease in a very minor way, do not give an obvious reaction to the tuberculin test; more progressive disease develops and later this may account for a number of reactors in the herd. It is unlikely that infection is maintained in any animals other than cattle, for the incidence of disease among them usually falls with the progress of eradication in cattle, and they are comparatively short lived. There is, however, the danger that a man who has contracted bovine type tuberculosis from contact with infected cattle may convey it to cattle in a herd from which disease has been eliminated.

Similar measures may be used against brucellosis, which causes abortion in cattle and was formerly very widespread throughout the herds in this country. Those countries which have succeeded in virtually eradicating this infection have usually begun with organized vaccination. S.19 vaccine prevents abortion and so reduces the weight of infection throughout the herds. Heifers vaccinated when 5–8 months old are protected up to their fifth pregnancy. Vaccination induces a reaction to the agglutination test but animals injected at this age usually give a negative reaction at about 18 months old. Thus vaccination in calfhood does not interfere with any radical method of elimination based on the test. A new scheme to be launched on the 1st May provides for vaccination of calves between their 151st and 240th day of life free of cost to the owners. Vaccination of adults is being discouraged.

Government action

Official action may be needed to complete eradication but generally it is taken only if a disease is a killer, spreads rapidly with serious effects on agriculture, or creates a public health problem. Nevertheless, an attempt may be made to stamp out a disease which might not otherwise be tackled in this way if it has only recently been introduced. Generally speaking, there has to be a stamping-out policy for complete eradication of a disease, but many can be brought under reasonable control by a variety of means, including vaccination. A slaughter policy may thus become possible. This is the situation with foot-and-mouth disease in a number of European countries.

Vaccination can also be used for swine fever. Unlike foot-and-mouth disease, this disease affects only one species and the position is not complicated by so many types of virus—foot-and-mouth disease has at least seven types for which a specific vaccine would be necessary. Better methods of diagnosing swine fever are available, there are better vaccines and the methods of spread are better understood. It is confidently expected that when a radical method of elimination is introduced in this country, perhaps next year, this disease may also disappear.

Sir John Ritchie, C.B., born in Turriff, Aberdeen, in 1904, was appointed the Ministry's Chief Veterinary Officer in 1952, following a distinguished career which has brought him from a post as County Veterinary Officer in Midlothian to an acknowledged leader in world veterinary circles. He was appointed C.B. in 1955, elected a Fellow of the Royal College of Veterinary Surgeons in the same year, and knighted in the New Year Honours List, 1961.

SUMMER MILK

R. J. Halley

Summer gives grass, and grass gives milk—two thoughts for dairy farmers whose profit margins aren't as high as they would like.

ECONOMIC and technical developments in recent years have resulted in a number of changes in the pattern of milk production in England and Wales. The number of dairy cows has been increasing whilst the number of milk producers has declined. This has resulted in an increase in the size of the average dairy herd, which should have contributed to greater efficiency in the production of milk. As the average lactation yield per cow has also increased with the greater number of cows, so the annual production of milk has risen. This situation has fortunately been helped by an increased consumption of liquid milk per head of population during the last four years, and the Milk Marketing Board deserves credit for its efforts to sell milk in this market.

But such increases in liquid consumption have not been great enough to absorb the increase in production, with the result that greater quantities of milk have to be diverted into the manufacturing market, which pays appreciably less than the liquid market. Recently, J. L. Davies estimated that the rise in production of milk will continue at the rate of 40 million gallons per

A herd of Friesians coming in for milking

year—the average rate of increase in the past ten years. If this comes about, then producers can anticipate more and more of their milk being sold in the less attractive manufacturing market.

The production of milk in excess of the requirements of the liquid market is uneconomic at present prices, and the National Farmers' Union has rejected the Government's proposal that milk should be produced on a quota basis. Since then the Milk Marketing Board has produced a scheme whereby milk is to be paid for on a quality basis. In time this should improve the average quality of the milk and possibly, thereby, increase the consumption of liquid milk. But if producers wish to maintain production beyond the requirements of the liquid market it is inevitable that this must reduce the returns per gallon by increasing the proportion used for manufacturing.

Cut food costs

There is, therefore, a paramount need to reduce costs of production. Food is the major item of cost in producing milk, and grazed grass is the cheapest source of food for the dairy cow. Thus if it were possible to produce the greater part of the milk for manufacturing during the summer, producers would benefit; but big variations in the supply to the factories, which creates problems in manufacturing, would follow.

In the past, the Milk Marketing Board has adjusted the difference between summer and winter prices paid to producers in order to alter the seasonality of production. Such adjustments must be made with great care if excessive movements are to be prevented. With the present pool prices, there is little doubt that the majority of producers find autumn-calving cows more profitable than spring calvers. In 1961 the M.M.B. offered optional contracts to a limited number of summer milk producers in South Wales and the Far West regions.

Under these optional summer contracts the prices quoted during the summer were greater and during the winter less than the general pool prices. The adjustments were designed to make summer milk production at least as attractive as winter milk production with the normal pool prices, and the results of this experiment will doubtless be of great interest to producers in areas where the climate favours good grass.

The potential saving in feed costs, obtained by changing from winter to summer production, results from a reduced use of concentrates and a greater use of cereals in the concentrate mixture; costs of providing the bulk food are not greatly affected. The actual saving depends, therefore, on the level of production that grass alone can support in the summer and on the level of production which can be secured from bulk foods fed in the winter. On farms where high levels of production are obtained from bulk foods fed in the winter an inducement, greater than that offered by the present special contract, would probably be required to justify a change to summer production. However, when maintenance only is obtained from bulk foods in the winter and a continuous supply of high quality grass can be provided in the summer, then a change to summer milk production might be advisable.

The problem is to decide the extent to which the present differences between summer and winter prices must be altered to attract a sufficient number of producers. If the adjustments are too great, an excessive movement in production is inevitable, as summer milk production has many attractive features. Beynon has calculated the effect of choice of contract (normal or special summer) on the value of milk produced by cows calving at different times and with different lactation yields. For cows calving during January, February, March and April, the special prices gave a slightly greater return. The differences were not great and amounted to a maximum of approximately £2 for a cow with a 1,000 gallon lactation, calving in February. As a cow giving 1,000 gallons and calving in February requires considerable quantities of concentrates for steaming-up and in early lactation, it appears that the special contract prices do not create a clear case for summer milk production.

Producers of Channel Islands milk have an easier decision to make. At the present time the quality premium is so much greater for winter milk than it is for summer milk that winter production is undoubtedly more profitable.

Changing the calving pattern of a herd is, too, a major practical problem. Either it can be achieved as a gradual process involving the bringing in of heifers calving in the spring or the whole herd has to be replaced by spring-calving cows. Few producers would wish to adopt the latter policy.

Better use of grass

Irrespective of the emphasis that may be placed on summer milk production in the future, it is clear that the *cost of producing milk must be reduced.* It is equally clear that the only way in which a major reduction in cost is likely to be achieved is by making better use of the grass crop. It has been demonstrated by experiments conducted on a farm scale that the increased use of fertilizers can reduce greatly the cost of producing milk, although this was inevitably associated with increased production. In the future, the major contribution that grass can make towards reducing cost is in the saving effected by feeding less concentrates. On innumerable occasions it has been shown that concentrates are fed unnecessarily to cows grazing good grass, and many experiments have shown that the use of concentrates under these conditions leads to insignificant and uneconomic increases in yield per cow.

Changing from haymaking to silage-making will also provide winter feed which is capable of supplying not merely maintenance, but maintenance plus one, two or even three gallons of milk. This again has the great merit of reducing cost of production without increasing the overall quantity of milk produced.

Ideally then, because grazed grass is so much cheaper than any other food for dairy cows, grazing ought to be available throughout the year. For the moment this is not possible, but more use could be made of existing strains of pasture plants and methods of fertilizing that greatly extend the grazing season. Further developments in plant breeding will certainly take place, and all-the-year-round grazing may become a reality much sooner than most farmers realize.

It would be wrong to pretend that efficient milk production off grass is a simple matter. The greater the reliance placed on grass, the greater is the need for skilled grassland management. Summer drought and the consequent shortage of feed is, for example, a major problem in all too many cases, but the use of greater quantities of fertilizer provides a considerable measure of insurance against this risk. With irrigation, of course, it is possible to plan with almost complete certainty a level output of grass of high feeding value. Without irrigation it is reasonable to expect a concentration of farms producing milk from grass to be found in those areas of the country with a higher rainfall. This has always been part of the traditional farming pattern, a pattern likely to become even more marked in the years which lie ahead.

For many small farms there is no financially attractive alternative to milk production. Hence for such farms, if they are to continue in business, grassland production must be improved to give a greater total output of grass, better quality herbage and a longer grazing season.

Mr. R. J. Halley, B.Sc. (Agric.), M.Sc. (Agric.), M.A., is a Senior Lecturer in Animal Husbandry at Seale Hayne Agricultural College, Devon, and has been Farm Manager there since 1959. He was formerly University Demonstrator and Assistant to Farm Director, University of Cambridge, and Manager of a 2,000 acre estate in Hertfordshire.

National Sheep Event, 1962

The National Sheep Breeders Association's three-day event will be held at Llandudno, North Wales, on 22nd, 23rd and 24th May, 1962.

Applications for Badges admitting to the entire programme (45*s.* each—N.S.B.A. members, 40*s.*) or for Daily Tickets (15*s.* each day) should be addressed to NSE Local Secretary, G. L. Williams, Department of Agriculture, Memorial Buildings, Bangor, Caernarvonshire; or to NSBA Secretary, C. R. Robarts, Rosewalk, Radlett, Hertfordshire.

From Farmer to Public

E. STRAUSS, of the Milk Marketing Board, looks at agricultural marketing in this era of developing pre-packaged and processed food

WE are living in times of major, almost revolutionary, changes in the distributive system. It is now fairly widely, though not universally, accepted that the individual agricultural producer is at a serious disadvantage in marketing his product and that, as far as he is concerned, the "market" confronting him could be a barrier rather than a link between him and his public. This is due to the existence of a complex chain of distribution which effectively separates him from his final market; in the special case of Britain, the only modern nation of its size which has pursued for over a century a policy of relying on large-scale food imports for its industrial population, the individual producer is, in addition, exposed to the uncontrolled vagaries of an international market in which purely economic considerations play a diminishing part.

New trends in food distribution

The traditional pattern of distribution in the food trades included typically a "*primary*" *wholesaler*, concerned with collection from the producer, grading and bulk sale, and a "*secondary*" *wholesaler*, buying in bulk from the primary wholesaler and selling larger or smaller parcels to the *retailer*.

Recent developments have tended to weaken the once prominent position of the wholesaler from opposite directions. On the producer's side, there has been the growth of organized producers' marketing which frequently includes the job of grading and making up bulk lots, previously carried out by the primary wholesaler. At the same time, there is the growing popularity of pre-packaged and processed food, which means channelling supplies through processing plants marketing their own products and cutting out the need for a special wholesale function.

Perhaps even more important has been the growth of large and powerful groups at the retailing end of the business. Amongst the earliest developments in this field was the "industrial" consumers' co-operative movement, followed by the advance of chain stores or multiples in food distribution as in other fields of retailing. This process has two distinct aspects. On the one hand, there is the successful grocer or provision dealer who opens one branch shop

after another until he owns a chain of shops of a similar type. On the other hand, there is the department store or the variety store which finds the addition of a food department or a food counter a useful contribution to its profits.

One feature which all large retail trading organizations have in common is their insistence on buying directly from producers or importers. Central buying means by-passing the wholesaler, whose function of breaking bulk is carried out within the organization. Particularly where food retailing forms part of a wider assortment of goods, there is also a much stronger emphasis on pre-packaging and uniformity of product—often to the extent that processing units are specially set up to cater for the needs of large customers of this kind.

These economic changes have become more pronounced as a result of the technical revolution in retailing through "self-service" stores and "supermarkets". Though a good deal of pre-packing is carried out on the premises of most of these shops, this development has given a strong fillip to the existing trend towards graded, uniform and attractively-packed produce, and it is only a matter of time before these requirements will be a must for efficient marketing.

Apart from weakening the hold of the wholesaler by excluding him from a substantial section of the trade, these changes are indirectly affecting him even in his remaining function as supplier of the "independent" retailer. One of the more promising attempts of these retailers to maintain themselves in the face of increasing competition from "multiples" and supermarkets is the formation of voluntary buying chains which aim at giving the independent retailer some of the advantages of bulk buying enjoyed by his rivals.

Collective marketing

If the farmer simply accepts these changes in the market, the results are unlikely to be favourable. He is confronted on all sides by high-powered modern business interests disposing of large capital, large organizations and well-trained specialist staff engaged in extracting the best possible terms from the market. Unless he wants to be an object of other people's economic decisions, he must use equally effective methods in the furtherance of his own interests. The answer evolved by primary producers in response to this challenge is the development of collective marketing organizations, either through voluntary co-operation or through compulsory marketing boards.

The marketing co-operative takes over the function normally carried out by the private wholesaler, including in many cases the processing of foodstuffs and other agricultural raw materials. This involves the collection and grading of the produce of its members and its sale in the most profitable markets, including the establishment of co-operative enterprises such as egg- and fruit-packing stations or dairy factories. In some instances producer co-operatives also engage in retailing, for instance in the milk trade. By these means they may reduce the cost of distribution or channel back to the farmer the profits made by distributors and processors. Apart from the vexed question whether these profits are too high or not, there can be no doubt about the fact that they are much more stable than those of the producer, whose returns may fluctuate violently from year to year, while those of firms engaged in handling farm produce vary rather less and not infrequently in the opposite direction. Apart from increasing the farmer's returns, co-operation may, therefore, contribute towards making them more regular.

Perhaps as a result of the relative weakness of marketing co-operatives, a different solution of the problem presented by the individual producer's lack of bargaining strength has been developed in this country—that of the statutory, producer-controlled Marketing Boards under the Agricultural Marketing Acts of 1931 and 1933. They are best viewed as statutory country-wide co-operatives with compulsory powers over all producers of the regulated commodity. They have substantial delegated powers which make some degree of Government supervision almost inevitable, but in their day-to-day operations they represent a form of producer control with interesting features of its own.

The voluntary co-operative pushes the point of sale beyond the farm gate—to the sale of the finished product by the co-operative or by a marketing organization combining a large number of co-operatives: it penetrates the distributive system deeply but on a relatively narrow front. The statutory Board may also have some processing and distributive establishments which are a very valuable marketing tool; but by and large it sells the regulated commodity itself to proprietary firms. In relation to the distributive system its operation is shallow but all-embracing; by replacing a large number of weak sellers by a single seller with certain powers over the operations of all producers, it improves the terms obtainable by the producer at the farm gate.

The changes taking place within the market make the operations of individual co-operatives a much less effective safeguard of producer interests than they were in less complex days and limit even the effectiveness of loose federations of co-operatives. To maintain and improve the position of the producer in this developing new situation, nothing short of organized action on a national scale will generally be good enough—and this new situation may well give nation-wide marketing organizations a decisive edge over voluntary co-operatives.

The crux of a Marketing Board's position is its regulatory power over supplies and its ability to obtain the best results from different markets for its product—technically known as price discrimination. This includes the use of its powers for stabilizing the market and for dealing with a temporary surplus. In this context these basic powers are taken for granted, and the following comments review mainly the factors which make broadly-based comprehensive organizations of particular value to producers in their struggle for a larger share of the consumer's purse.

Large-scale marketing in practice

The need for marketing on a national scale derives from the fact that the market itself is a national one and that the means of maintaining and improving the producers' position are partly dictated by the actions of their large-scale competitors, though there may be room for constructive alternatives. The task of widening the market for farm produce in modern conditions puts a heavy premium on size and financial resources. Its basic condition is comprehensive market research; though indispensable, it is expensive enough to make its use economic only for big organizations operating on a national scale and capable of making full use of its results.

The same applies with even greater force to advertising and publicity, which is big business of a very high order and expanding rapidly. In 1957 the country spent about £333 million on advertising, and by 1960 this had risen to £453 million; in 1961, it was probably little short of £500 million, or almost £10

per head of the population. Whether advertising on this scale is economically justified is an open question, but massive publicity has become an unavoidable expense of successful competition—and it is quite out of reach of any but a large organization backed by strong resources.

No amount of publicity will sell products which are not right for the market, i.e., of a reliable quality appealing to the consumer, in the form in which he wants it. This may involve a loss in variety and some standardization. Although a pity in some respects, this may be part of the price to be paid for the application of modern merchandizing techniques which involve, almost by definition, large-scale—and preferably country-wide—operation.

Another important, and perhaps vital, aspect is the task of systematic sales promotion. In this field a good deal can be done by local effort, because there are quite strong differences in tastes and habits between different parts of the country, but in other respects national action will again be required for best results. The need for such efforts arises from the—sometimes surprisingly large—gaps in the existing distributive system and the corresponding gains which can be obtained for the producer by ensuring that his produce is available at any time and place where there is a demand for it.

Finally, there is no question about the great potential rewards of successful product development, either by introducing new uses for existing products or by developing new ones. This is only possible with a good deal of ingenuity, luck, patience—and money. But it is a challenge to a forward-looking industry which does not wish to rely on the wasting asset of popular tradition and inertia.

A MISSING LINK

Weed Control in Sugar Beet

It is difficult to control weeds on sugar beet fields by spraying chemicals once crop seedlings have emerged. Few chemicals are sufficiently selective to kill a useful range of weeds without checking the crop.

It is sometimes possible to use contact herbicides to kill weed seedlings just before the beet seedlings emerge. Good results can often be achieved particularly with weeds like charlock which germinate fairly quickly. Many important weeds, however, such as knotgrass or chickweed, tend to germinate slowly, and may not be effectively controlled in this way.

Recently much effort has been concentrated on the development of soil-acting herbicides. These are applied within a day or so of sowing and kill any weed seedlings which germinate for a period of time. Their effectiveness is very much bound up with soil type, soil moisture and the fineness of the tilth produced, but both IPC and IPC/Endothal mixtures are now on the market for use in this way and under good conditions a reasonable control of annual weeds is obtained. It is necessary to avoid excessive damage to the beet, which can happen particularly on light land, and a reduced dose is normally recommended for these conditions.

Weed control in sugar beet is one of the missing links in arable farming. Until it becomes consistently successful and reasonably cheap, the full mechanization of the beet crop in the spring cannot be achieved.

Cleaner Sugar Beet

J. R. Masters

In the early days of sugar beet-growing in the 1920s no particular attention was paid to the removal of soil when delivering beet to the factory. The crop was lifted and loaded by hand for delivery by road or rail, and little effort was made to separate soil from beet.

It is not surprising, therefore, that growers took the attitude that it did not matter what condition the beet were in, the factory would accept them. Another factor was that in earlier days the 18 factories were controlled by 15 different companies, all endeavouring to build up confidence and goodwill and in consequence anxious not to offend growers by adopting a tough attitude. Consequently they accepted deliveries of beet with excessive dirt.

During the 1930s, whilst the majority of sugar beet growers were still loading by hand, a few had bought root elevators. These machines usually had either a solid or slatted floor, so that beets were forked into a small hopper under which there was very little clearance. A large proportion of the soil was necessarily taken up by the elevator into the vehicle, and excessive loose soil accumulated in the lorry directly under the top of the elevator. Where such elevators are used, the same thing still happens today.

This, then, is the background to a problem that began to exercise the minds of many who were engaged in the sugar beet industry in the mid 1930s. In 1936, the newly-formed British Sugar Corporation was thus faced with accumulated mounds of soil on nearly every factory site. The steady increase

in land values and scarcity of dumping sites were among the difficulties which had to be tackled, and they were not made any easier by the outbreak of war in 1939.

Post-war mechanization

From 1946 onwards came the big drive towards mechanization of the harvesting of sugar beet—from less than 1 per cent of the crop harvested by machine in that year, the figure rose to approximately 65 per cent by 1960. During this period came the introduction of the tractor-mounted fore-end loader, as a means of loading beet into lorries. Many of the early harvesters left the beet in windrows on the ground, and a few loaded direct into trailers. Some of the cleaning mechanism was quite effective, but inevitably some excessive soil and trash found its way into clamps which were usually sited on the headland near the gateway.

As farmers were anxious to reduce the costly hand work, they turned more and more to machine harvesting and loading lorries direct by means of fore-end loaders, usually from clamps sited on soft ground. The outcome of this type of handling was to increase considerably the quantities of loose soil and trash being loaded into the lorries. It was not uncommon to find that some growers were getting returns showing dirt tares of 35–55 lb per cwt, and during wet weather, on occasions, even higher.

By the mid-1950s harvesting machines had developed rapidly, cleaning mechanisms had been much improved, and almost all had direct loading devices; but so far cleaner-loaders were almost non-existent, although agricultural engineers were busy with development plans.

Clause 14 of the contract states that beet shall be as free as possible from soil, and loose leaves, weeds, stones, straw or other foreign matter shall not be loaded with the beet. Unreasonably dirty loads are therefore not in accordance with the grower's undertaking, and the sugar factories are not now so tolerant in their acceptance of such beet. Growers, large and small, as well as haulage contractors are thus taking a far more active interest in cleaner-loaders.

Less dirt demonstrated

The two national demonstrations of cleaner-loaders which the British Sugar Corporation organized last November attracted a great deal of attention. Growers were able to see the wide range of machines available, from the small chute into which a fore-end loader empties its content before going up the elevator, to the large and more expensive rotating cage types suitable mainly for larger growers and haulage contractors. The results of the samples weighed before and after cleaning were most impressive and confirmed that these modern cleaners can reduce tare by up to 50–60 per cent on heavy soil, and over 80 per cent on light land.

The Agricultural Development Department of the British Sugar Corporation has summarized the results obtained at these demonstrations. These results show clearly the striking reduction in tare that can be made by using cleaner-loaders.

Ten machines were demonstrated at Redbourne, nr. Brigg, and the cleaning efficiency was compared with direct loading and hand loading. As the beet were grown on light land, the cleaning was expected to be fairly good. The initial dirty tares before cleaning varied from a minimum of 34·1 lb per cwt

Rotating cage cleaner-loader in action

to a maximum of 45·4 lb per cwt. After cleaning, samples were taken again and it was found that dirt tare was reduced to a minimum of 4·0 lb per cwt, and a maximum of 7·2 lb per cwt. These figures clearly indicate the tremendous saving that can be made in haulage costs. It is also interesting to note that samples taken after direct loading averaged 33·9 lb per cwt. This indicates that almost all the initial soil on the beet was loaded on the vehicles.

Hand loading reduced tare to 8·3 lb per cwt, but this method is far too costly from the labour point of view. The rate of loading in this case was 32·2 man-minutes per ton, compared with about 2·4 man-minutes per ton by mechanical methods.

At the second demonstration, held at Saling, nr. Braintree, the soil was very much heavier. Here we were able to compare the efficiency of these cleaners under more adverse conditions. Initial dirt tare was much the same as with the Redbourne beet, but naturally the heavier soil was more difficult to remove. After cleaning, the dirt tare varied from a minimum of 9·1 lb per cwt to a maximum of 17·5 lb per cwt. These figures are also quite impressive. Summarizing the two demonstrations in a very few words, it is fair to say that on the light soil tare reduction amounted to approximately 83 per cent and on the heavy soil 55 per cent.

It is important, however, to mention that some growers consider this tare reduction simply in terms of savings on haulage, and argue that on this basis the capital expenditure on a cleaner-loader is not justified. That may be true in some cases, but the real answer to this question is the factories' requirement of *clean beet*. The use of a cleaner is desirable if growers are to avoid additional costs that would be incurred by having their beet rejected.

Still further improvements

Some farmers have made their own cleaners, and these are usually very successful because they have been designed for a particular job and soil type, to fit in with the grower's system of harvesting and delivery. During the last year or so, many more improvements and refinements have been made by manufacturers of beet harvesters making the cleaning devices on their

machines more efficient—for instance, by improved web chains, by angled wheels to squeeze the beet out of the ground instead of the orthodox shares, and by incorporating a built-in hopper on the harvester which can be discharged at the end of the field into a trailer, for this also gives the beet an additional cleaning.

Using a fore-end loader for direct loading can only result in high tare, even if the loading point is a hard surface. To be fully effective a fore-end loader should be used in conjunction with a cleaner-loader, or the simpler chute and elevator.

A chute is cheap and effective on light soil, but on heavy soil when conditions are wet it is less effective. This tool is mainly suitable for growers with small acreages of beet, where the expense of a large power-operated cleaner is not justified.

Organize for clean beet

Clamping of the beet should be done on a good accessible site; otherwise even if a cleaner is used, the fore-end loader will pick up a lot of soil and its efficiency will be impaired. The most effective system is to have the beet loaded with the fore-end loader from a concrete loading base into the cleaner-elevator. Most modern cleaner-loaders have a high ground clearance; thus the soil accumulating from the beet can readily be removed and put back on the fields.

As previously mentioned, many hauliers are using cleaner-loaders, for which in some cases a small charge is made and in others the service is free. More growers are now insisting on this service.

Properly organized, the harvesting and loading of beet can, with the aid of modern machinery, be done with a minimum of labour. Considerable saving can thus be made, not only in the actual harvesting, but also with the loading,

Simple chute type cleaner-loader, valuable to small growers

since one man only with a fore-end loader is required to fill from a cleaner into the lorry. In addition, a considerable saving on haulage is made by the reduction in dirt tare.

To sum up, the operations of harvesting, cleaning and loading of sugar beet have now reached a stage when they no longer necessarily create a problem. For the growers there is the advantage of first-class harvesting machines with excellent cleaning mechanisms, the choice of various makes of cleaner-loaders, from simple but effective cheap machines to the larger high-capacity more expensive types, and fore-end loaders. In order to use these implements with maximum efficiency, the beet must be loaded from a concrete loading base centrally sited in relation to the beet fields. The haulage contractors must come more and more to the fore. They have a great share in hauling beet from small growers who cannot afford specialized equipment, and thus they should consider providing an adequate cleaning service. The factories may be able to help in this respect by arranging with growers that deliveries can be made in such a way that the haulier has less running about with his equipment.

Mr. J. R. Masters is Head of the Agricultural Department of the British Sugar Corporation's factory at Wissington, near King's Lynn.

Memorial to "Bobby" Boutflour

AN appeal is being launched to provide a memorial to the late Professor Robert Boutflour. Although arrangements are already in hand for a memorial within the Royal Agricultural College on behalf of former College students and governors, the signatories feel that something else could well be established to the memory of this remarkable man who did so much pioneering in the breeding and management of the dairy cow.

The exact nature of such a memorial has not yet been decided, and suggestions would be welcome from those subscribing. A residential or travelling scholarship has been suggested.

Donations and suggestions should be sent to Mr. W. T. Price, Principal of the Harper Adams Agricultural College, Newport, Shropshire. It is thought that subscriptions should be limited to a maximum of 5 guineas but considerably lesser sums will be very welcome.

The ten signatories of the appeal are: Sir Richard Haddon, Mrs. Gerald Strutt, Messrs. Malcolm Messer, H. M. Astley Bell, Tom Baddiley, John Clapham, James C. Leslie, Jack Moffitt, John Phillips and W. T. Price.

SLATS

Less litter, less labour.
Two reasons for thinking about slatted floors

N. K. Green

AGRICULTURAL LAND SERVICE, LONDON

STRAW for litter has been scarce and expensive to handle in recent years—hence ideas of housing cattle using little litter or none at all.

One method is to have a floor, made of slats (or bars) with gaps between, and with a cellar underneath to collect the dung and urine excreted by the cattle living on the slats. Floors of this kind have been tried out by dozens of farmers in England and Wales, using slats of wood or concrete, and it has been found that concrete is to be preferred because it does not warp or wear, and is less slippery.

The best width for slats is 4 or 5 inches, and for the gaps, ½ inch to 1½ inches. The smaller the animals the narrower the gaps, ranging from 1½ inches for adult cattle down to ½ inch for calves up to 6 months old.

The depth of the cellar below is related to the density of the animals on the slats and the frequency of mucking out. For example, with dairy cows, dung and urine accumulate at a rate of about 1 cu. yard per head in 20 days. It follows that, with 35–45 sq. feet of floor area per cow, and with mucking out done every 20 days, the depth needs to be about 1½ feet. If water has to be added to the muck, to enable it to be pumped out as sludge, twice that depth may be needed, i.e., 3 feet.

Where the muck is flushed out, say twice a week, the depth may be as little as 9 inches. Where mucking out is done only once a year, it should be 8 feet 6 inches to enable a tractor to work under the slats.

In between these two extremes, it is possible to have a depth of 3 or 4 feet, either with slats that can be removed altogether during mucking out, or with slats that can be removed a few at a time, to enable a tractor to work on the slats that are left.

In this latter case the tractor is fitted with a special scoop that dips down into the muck from above and bails it out into a spreader, also on the slats.

A restricted use

Compared with a floor bedded down with straw, wood shavings, sawdust, or sand, there is little doubt that a slatted floor is uncomfortable and likely to cause injury to animals. A solution may therefore be not to keep animals entirely on slats, but to have slats only where they stand and feed (and drop most of their excreta). They can then lie on a separate littered area, which does not take so much litter because it keeps cleaner.

One interesting development is the use of slats to prevent slurry accumulating at the silage face when cows are on a self-feed system. Another is the use of a slatted floor for drying bales of hay in summer. The bales are stacked on the slats while warm air is blown up through them from the cellar below.

"Climax" water-pumping windmill

Windmills to supply electrical power can be a boon in isolated areas

Water Pumping and Electricity from Windmills

by E. W. Golding

WINDMILLS for water pumping and small-scale electricity supplies have been installed in appreciable numbers in the drier regions of the world and in up-country areas remote from main electricity networks. They are, indeed, also to be found in Britain, particularly those of the water-pumping type: many small wind-driven electric generators were used until quite recently in Wales and on the Scottish islands, though most of these are now less necessary because of the extension of our electricity supply system.

Where mains electricity is available it can usually provide electric lighting at much lower cost and with greater reliability as a continuous service. There are, however, definite limits to the distances which can be covered economically in the distribution of small quantities of electric power, and windmill generators have certainly a part to play in catering for the needs of isolated premises. Although only a few thousand farms in Britain may fall in this category, very large numbers in thinly-populated areas abroad are unlikely to receive electricity supplies for many years to come.

There is a strong case for the use of wind power for water pumping. First, there is no question of transmitting the power to the site: a wind-driven pump can be erected at a well however remote it may be. Second, the characteristics of a water pumping load are well suited to those of wind power: the water can be pumped at random times, as the wind blows, and the energy can be stored, in effect, in the water-storage tank.

Characteristics of wind power

Not the least of the advantages of wind power is that it is free and inexhaustible; it also becomes available at the spot where it is wanted. Its obvious disadvantages are that it does not always exist in sufficient quantity when it may be wanted and that it is diffuse, so that the size of the machine needed to harness a given amount of power is relatively large.

The power (in h.p.) in a windstream is $0{\cdot}0000067\ AV^3$, where A is the cross-section of the stream, in square feet, and V is the wind speed in miles per hour. The power, in kilowatts, is $0{\cdot}000005\ AV^3$. A wind-driven machine can, of course, extract only a fraction of this power—perhaps 10–20 per cent for a water-pumping windmill, and 20–30 per cent for a wind-driven electric generator.

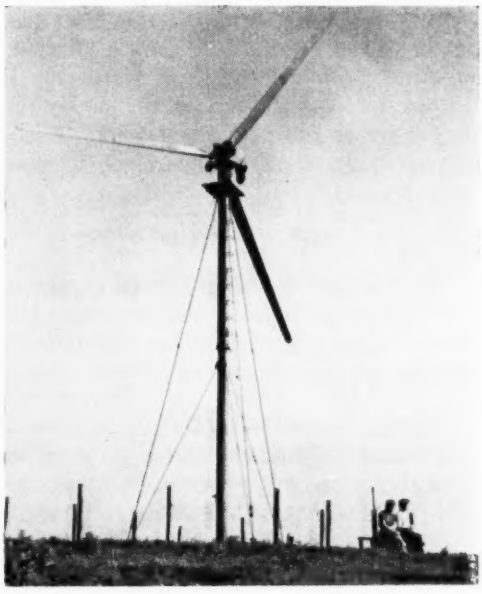
It is clear, therefore, that the wind speed is an especially important factor in the power production; similarly it is important to select the right site for the installation (if selection is possible in a particular instance) to get a high annual average wind speed. Well-exposed sites on the tops of smoothly-shaped hills are best: wind speeds at their summits are often at least 50 per cent greater than those on lower ground nearby. Unfortunately choice is not often possible with small installations because the windmill must be located close to the well or the premises. Obstructions in the form of trees or buildings must certainly be avoided if good results are to be obtained.

The wind speed throughout the year, at any site, may vary in random fashion from zero to perhaps 100 miles an hour, but the annual average for a site seems to vary very little from year to year. Thus, although it is not possible to depend upon power being available at a specified time, there is near-certainty of a predictable quantity of energy throughout the year. A windmill cannot, economically, be designed to make full use of the whole range of windspeeds. It "cuts-in" at some fairly low wind speed, generates more power as the wind speed rises, and at the "rated wind speed" produces its full power output. For still higher wind speeds, the power must be governed by some form of wind spilling, so that full rated output is not greatly exceeded. The "cut-in" point for the common water-pumping windmills is about 6–7 miles per hour, giving full output at about 13–14 m.p.h. Small electricity-producing windmills need higher wind speeds: they cut in at perhaps 10 m.p.h. and give their full power at 15–20 m.p.h.

In assessing the potentialities of wind power at a particular site, it is important to know the average wind speed and, if possible, the maximum durations of calm spells. Full records of hourly wind speeds at the site throughout the year would be ideal but these are available only for Meteorological Office stations. Data from the nearest M.O. station are, however, usually valid enough for application to a selected site, unless this happens to be at a very favourable place, (e.g., a hill top) when the wind speed will probably be higher than at the M.O. station.

An interesting fact is that the hourly wind speeds at any site (in Britain) generally exceed the annual average value during 46 per cent of the year. Meteorological Office records, for a long period of years, show that annual average wind speeds in the British Isles vary from 17·5 m.p.h. (along the western coasts) to less than 10 m.p.h. (in the central areas of England and Scotland). It is, therefore, safe to conclude that in most areas, excepting perhaps more sheltered central districts, water-pumping windmills—which operate at wind speeds above 6 or 7 m.p.h.—will produce power during at least half the year.

More detailed knowledge of the wind régime at site (besides the annual average speed) is useful as a guide to the need for energy storage—to cater for calm spells—and to the relationship between availability of wind and power needs for water pumping, or electrical, purposes.



"Allgair" 8kW electric windmill in the Scottish Highlands

Measuring windmill outputs

Although circumstances may sometimes favour wind power in relation to other methods of power production, there is, of course, competition between them. It is important, therefore, to estimate the costs of operating windmills as a basis for economic assessment of their potentialities.

Since running costs (for lubrication and very occasional attention) are usually negligible, the operating costs can be taken as merely the capital charges, for interest and depreciation. The annual energy output depends upon the rated power output of the plant and on the wind régime at the site.

Suppose that the latter is represented by the velocity/duration curve shown in Fig. 1(a), drawn from annual recordings of hourly wind speed for a site having an annual average wind speed of 10 m.p.h. If the cut-in point for a windmill installed at this site is 7 m.p.h., the machine will give some output (varying from zero to full power) for 5,700 hours in the year. If the rated wind speed, for full output, is 15 m.p.h., full power will be produced during 1,700 hours. (In practice the power will probably rise slightly at wind speeds above 15 m.p.h. but, for a conservative estimate, this fact is neglected.) In Fig. 1(b)

Fig. 1(a).

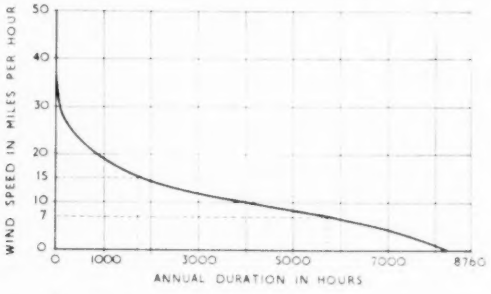
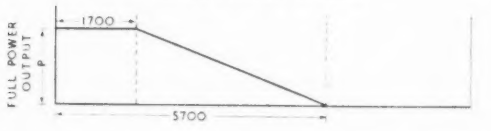


Fig. 1(b).



the power graph is drawn on the assumption that the increase in power, from cut-in to full power P, follows a straight line law. This is close enough to practical peeformance to be justifiable in estimating the annual energy output, i.e., the area under the power graph, is $P(\frac{1,700 + 5,700}{2})$, which is equivalent to full power output for 3,700 hours in the year. In general, the annual duration of the equivalent full power output is

$$\tfrac{1}{2}\left\{\begin{matrix}\text{Annual duration of wind}\\ \text{speed above cut-in point}\end{matrix} + \begin{matrix}\text{Annual duration of wind speeds}\\ \text{equal to or above the rated value}\end{matrix}\right\}$$

The full power output can be expressed, in the case of a water-pumping windmill, in gallons of water per hour against a head of H feet or, for a wind-driven electric generator, in kilowatts. The corresponding annual energy outputs are then in gallons of water and in kilowatt-hours.

Taking representative figures to show the order of costs, let the installed costs of an 8 ft.-diameter water-pumping windmill be £180 and take the annual capital charges as 10 per cent. Pumping against a head of 100 feet, the machine will provide about 400 gallons an hour at a wind speed of 15 m.p.h.

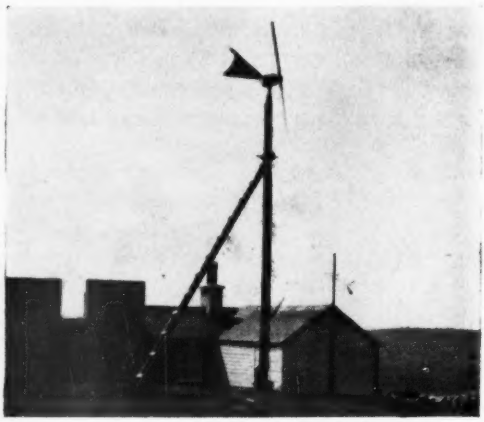
Annual costs = 10% of £180 = £18.

Annual output (at a site with a wind régime as in Fig. 1(a) = 3,700 × 400 = 1,480,000 gal.

Cost per gal. $= \dfrac{18 \times 240}{1,480,000} = 0{\cdot}003d.$ or 3*d.* per 1,000 gal.

Alternatively, consider a 1 kW wind-electric generator costing £250 with annual charges of 15 per cent or £37·5 (to allow for high depreciation on the storage battery). In the same wind régime and with the same operating range of wind speeds, the output would be 3,700 kWh and the energy cost would be $\frac{37{\cdot}5 \times 240}{3,700} = 2{\cdot}43d.$

Actually, this wind-speed operating range of 7–15 m.p.h. is rather low for a wind-electric machine, installed at a comprehensive cost of £250 per kilowatt. A range of from 10 m.p.h. to 20 m.p.h. would be more practical. The annual duration of equivalent full power output would then be only 1,800 hours instead of 3,700 and the energy cost would rise to almost 5*d.* per kWh.



Lucas "Freelite" 550W windmill in the Shetlands

Rates of water pumping

To return to water-pumping windmills, rather loose statements are often made about the rates of pumping which they can achieve. Probably a maximum value for the overall efficiency of these machines is 20 per cent and, taking this figure, the *maximum* rates of pumping, against 100 ft head, for windmills having wheels of 6 feet, 10 feet and 14 feet diameter would be as shown in the table.

Maximum water pumping rates for windmills (20% efficiency)

Wind speed (m.p.h.)	Pumping rates for three wheel diameters		
	6 feet	*10 feet*	*14 feet*
	(gal/hr)	*(gal/hr)*	*(gal/hr)*
7	25	72	138
10	75	200	400
12	128	360	700
14	204	580	1,120
16	306	860	1,660
18	436	1,220	2,400
20	594	1,660	3,200

For comparison, costs of water pumping by alternative methods are:

(a) *Electric drive*, using a ½ h.p. motor to pump 350 gal hr against a head of 100 feet
—2·7*d.* 1,000 gal with electricity at 1*d.* per kWh.
—4·1*d.* 1,000 gal with electricity at 2*d.* per kWh.

(b) *Petrol engine drive*, using a 1 h.p. engine to pump 350 gal hr against 100 ft head. Fuel consumption: 1 pint per hour, at 4*s.* per gal. Fixed charges 20%. Cost per 1,000 gal = 19*d.*

Types of windmill

By far the commonest water-pumping windmill now in use is the non-electric type, having a slow-running wheel composed of a number—usually 8 to 12—of galvanized sheet-steel sails and driving a piston pump through a gear box. A sheet-steel tail-vane holds the wheel into the wind. The wind shaft is slightly offset from the centre of the tower and, in strong winds, it turns out of wind under a spring control, thus regulating the power output. Wheel diameters range from 6 to 18 or 20 feet.

These machines are characterized by slow running and high starting torque. They start at low wind speeds but inevitably have a low efficiency. Since, however, the input power is free, low efficiency is not, in itself, a serious drawback, provided the cost per unit of power capacity can be kept low enough for economy.

In Holland, and in France, water-pumping windmills having 3- or 4-bladed propellors, and running at higher speeds, have been introduced, especially for drainage work where heads are low. They drive rotary pumps, the torque characteristics of which are suited to their own aerodynamic characteristics. Windmills for the generation of electricity are also of the high-speed propellor type. In the smallest sizes (under 1 kW) they drive a direct-current generator charging a battery to store energy for use in calm spells, but several machines of larger capacity, 8 kW up to 30 kW, have been introduced in the last decade. These larger machines may have direct or alternating-current generators but only a small fraction of the total energy is battery-stored. The remainder of the output is used as random power, perhaps controlled through an automatic load distributor.

Possibilities

In areas remote from electric power networks but which have annual average wind speeds above (say) about 8 m.p.h., there is great scope for windmills both for water pumping and electricity generation. Even on farms with an electricity supply to the farmstead it may be worth while to install a non-electric windmill for water pumping at a field well rather than running a long line to an electric pumping set.

In general, small windmills, whether electric or non-electric, are robust and require little maintenance. They can often provide amenities in remote places at a cost which is competitive with any possible alternatives. But in any particular case the cost of the windmill and its probable output—as estimated from wind data for the site—should first be carefully studied.

Mr. E. W. Golding, O.B.E., M.Sc. (Tech.), M.I.E.E., is Assistant Director and Overseas Liaison Officer of the Electrical Research Association.

Pig Feeding

Howard S. Teague

Ohio Agricultural Experiment Station

Food into flesh is the concern of every pig farmer. Professor Teague, who was recently in this country on a visit, puts his finger on several important aspects of any feeding programme

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In meat production there is a constant demand to improve the efficiency with which feed is converted into edible meat products. The different breeds of livestock, feeds available, management practised and the finished products desired by the consumer create different conditions between, and even within, the major pig-producing countries of the world. However, objectives in common are the need for quick and efficient growing animals, efficient reproduction and for the kind of finished meat products which the consumer wants.

Feed for the pig represents approximately 80 per cent of the total cost of production. It is for this reason that most research has been related directly or indirectly to feeding requirements. Our knowledge concerning requirements continues to increase, but many gaps are still apparent.

Suckling pigs

Beginning with the newly-farrowed pig and recognizing that sow's milk is nearly a perfect food for it, supplementation of the milk supply is accepted

as sound practice. In addition to providing iron in some form to prevent anaemia, the early consumption of a creep feed is of the utmost importance. For the first creep feed, exact formulation to meet nutritional needs is not as important as making the feed palatable. In this feed can also be included medication which might be beneficial to the pig at an early age. Defining an early creep feed as one consumed prior to the fifth week of age, ingredients known to be palatable are oat groats in cut or rolled form, lard, dried fish solubles and sugar. The pig between two and five weeks old should consume from 3 to as much as 7 lb of a palatable feed. Since this quantity is low and variable, any medication such as antibiotics, sulpha drugs, arsenicals or nitrofurans, if to be consumed in an effective quantity, must be added at higher levels than those in other pig feeds. The inclusion of as much as 100 grams of a tetracycline antibiotic per ton in this first creep feed seems beneficial.

For a creep feed to be made available after the fifth week, a more complete formulation is required. The sow's milk at this stage is becoming increasingly less of the total dry matter intake of the suckling pig, and there is a greater remaining appetite for a supplementary feed. A protein level of 18 per cent in such a feed is commonly recommended. In formulation, the vitamin and mineral requirements, as established for pigs off the sow, are usually met. The feed is of course still supplementing sow's milk, so many of the nutrient levels commonly maintained may be higher than required. If high in cost,the need for milk products in creep feeds can be justified only from a standpoint of palatability. The recommendation that an antibiotic level of not less than 40 grams per ton should be maintained in this later creep feed seems to be justified.

Suckling pigs have very efficient conversion of feed to flesh, and therefore any effort on the part of the producer to provide better feed and management will return more per unit of feed cost than at any other time in the pig's life. The growth potential of the pig at this age is seldom realized.

Sufficient information is now available for the formulation of substitute milks and starter feeds which are satisfactory for pigs weaned at any age. The early weaning of pigs calls for greater management skill and is practical under some systems of intensified production. Also such a system has some merit in the control of certain diseases. However, in most instances weaning earlier than 5 weeks of age is not yet advisable and often proves to be unprofitable.

Growing-finishing pigs

Primary factors influencing the feeding and management of growing-finishing pigs are price and availability of the major source of carbohydrate and supplementary protein, as well as market specifications and demand as represented by price differences for the quality desired. To these factors must be added the availability of facilities and labour for a particular management scheme. As the premium on carcass leanness continues to increase, more attention has been paid to nutritional factors influencing leanness and fatness in the carcass. It seems certain that the level and ratio of certain essential amino acids such as lysine and methionine bear a direct relationship to lean and fat deposition in the pig. And not only level but availability of the amino acids appears important. Thus a good deal of research will be needed to determine the requirement for certain of the amino acids and their inter-relationships with other nutrients.

In the past decade attention has been focussed on the addition of small quantities of non-nutrient materials to rations. These include the antibiotics, arsenicals, additional copper and certain of the sulpha drugs. Although they appear to improve performance under most feeding conditions, an understanding of their basic mode of action is very incomplete. The antibiotics, in particular, have found widespread use. Recommended levels vary with the price and availability of the product in question, as well as with measures to regulate feeding. The exact conditions under which a response is elicited are not understood, so there is a tendency to use more than one of the additives in growing-finishing feeds. Reliance tends to be placed on the combination to confer benefit under a wide variety of conditions. Such formulation is costly and points to the need for more research to gain a better understanding of the physiological and biochemical role of the additives in the animal.

Carcass characteristics vary between breeds, thus giving certain breeds an advantage over others for the production of pork to meet specific market requirements. As the pig industry looks to the future, permanent progress can be made where selection is used to develop a type of animal that will produce a desirable carcass under the simplest feeding and management scheme. This will have many advantages over alteration of the carcass by feeding.

Sows and gilts

Because of the difficulties encountered in conducting research with the gilt or sow, the exact requirements for reproduction in pigs are poorly understood. Evidence suggests that the performance of the gilt can be influenced by nutrition before reaching breeding age. Also it appears that the gilt not only has exact nutrient requirements but that performance is influenced by level of feeding at various stages in the reproductive cycle. This is illustrated by an increased level of feed (primarily energy) just prior to breeding, which results in an increase in the number of eggs ovulated at breeding time. To lower early pre-natal loss, the feed should then be reduced for the remainder of the gestation period. A rate of gain of approximately 80–100 lb during gestation in the gilt and 70–90 lb in the sow appears to give the best performance. Although exact nutrient requirements are insufficiently understood, careful attention should be given to the protein, mineral and vitamin content of the gestation ration. Present evidence lends little support for the addition of antibiotics and other feed additives to breeding, gestation or lactation rations.

Feeding in the future

A brief look at pig feeding in the future suggests that there will be a gradual reduction in the number of breeds used for the production of pork, with intensified selection for those traits demanded by the consumer. As an aid in the control of pork quality, greater use will be made of nutrition as a tool. Because of the economics of production, pigs will continue to be marketed at lighter weights. In research greater emphasis will be placed on determining the nutrient requirements of the sow, a better understanding of the fundamental role of feed additives, amino acid requirements of the growing-finishing pig and factors influencing efficiency of feed conversion. Because of the many genetic and environmental factors now known to cause variation in the performance of pigs, greater caution will be taken in applying the findings of research under each new set of conditions.

Do Cloches Pay?

This article by **A. MOORE,** *the N.A.A.S. Horticultural Officer in Worcester, describes Mr. A. H. Moule's smallholding and its 7,000 cloches*

WHAT does the future hold for small horticultural holdings? The pessimist would have us believe that there will be little if any margin of income over expenditure, while even the optimists agree that a good profit will be more difficult to get. But there does seem to be general agreement that some form of protected cropping will more easily enable the grower to make a profitable livelihood. In this connection the holding of Mr. A. H. Moule, of Ombersley, Worcester, is worthy of study.

Tony Moule specializes in growing crops under grower's barn-type cloches. The holding is some six miles north of Worcester, on the east side of the River Severn, 30 feet above the valley. There is a slight slope to the south and the soil is a deep well-drained light loam. The holding is therefore well sited for cloche growing, and this point must be borne in mind when considering the cultural details and returns given later in the article.

Two acres

In all there are just over 2 acres on the holding, and the entire area is devoted to cloches on the strip cropping principle. The land is divided into

strips wide enough to take two rows of cloches, with a path of at least two feet between each strip. Alternate strips are cloched so that at each cropping change the cloches can be easily and conveniently moved from the crop that has been harvested or started into growth to the crop that needs to be covered. This method saves money, since the glass is moved only a small distance—and a big saving in breakages too. It needs 7,000 grower's barn cloches to cover the two acres in this way, and Mr. Moule would have no other type. The whole is looked after by Mr. Moule and one part-time female helper.

The fertility and structure of the soil are of considerable importance, and much care is taken to build up and maintain fertility, mainly by using bulky organic materials. A dressing of 60 tons per acre of farmyard manure is given annually, usually at the end of April when the lettuce have been cleared and before planting tomatoes. It is not used prior to runner beans, since it grows too much bine. The farmyard manure is supplemented by compound fertilizers according to the crop being grown, but with the high level of organic manuring the main requirement is potash. Peat has been tried as a substitute for farmyard manure but it is very expensive. Wool shoddy is another alternative, and small areas have been dressed from time to time.

There is no extensive irrigation system on the holding, although irrigation to a limited extent was installed last year. In Mr. Moule's view there is not much advantage to be gained by irrigation if the water-holding capacity of the soil is good, although he admits that it is usually necessary when planting strawberries in August, and he may use it more often in the future.

The main equipment at Ombersley is a Ferguson tractor and an 8 h.p. rotary hoe. The ploughing is all done with a one-way plough to avoid furrows. The rotavator is essential to obtain a fine tilth at all times of the year, and so far there have been no troubles due to panning. When planting out small plants, such as lettuce, a fine tilth is essential.

Full use

Mr. Moule's aim is to keep the cloches in production for as long a period of the year as possible. Stacking is very unprofitable but if they must be stacked, and it is sometimes difficult to find a use for all of them in September and October, then the stacking is done on black polythene to keep down the weeds and help prevent the growth of algae on the glass. Even so it is usually necessary to clean the glass after stacking.

Although there are 7,000 cloches on the holding now, Mr. Moule started with much less than this. In fact he started in 1956 with 900 cloches, costing £250—"all the money I had and not a lot of knowledge to go with it", he says. He would advise a newcomer to start with at least 1,500 of the grower's barn type, which at present-day prices will cost £520. Allowing for strip cropping and pathways, these will occupy nearly half an acre of land and give 1,000 yards of covered crop at any one time. An initial purchase of less than this will result in an uneconomic unit, rarely giving sufficient of any crop to make a useful quantity for market. Ideally a purchase of twice this number is advisable, since the acre of land so covered will, when intensively cropped, fully occupy the time of one man and provide a continuity of market supply. Even as an adjunct to an established holding for such purposes as plant raising, a small area of cloches can be a very unprofitable item if they are stacked for most of the year.

The cropping programme at Ombersley is carefully thought out for as long ahead as possible to give a balanced rotation on the land, to give a continual and even labour requirement and, above all, to grow what the market can sell readily.

Lettuce

Lettuce is by far the most important crop—planted before Christmas and harvested during March and April. In between they are hoed twice, but trials are now going on to try to cut out some of this time-consuming operation by the use of a residual herbicide. C.I.P.C. is favoured, following the work at Luddington Experimental Horticulture Station and N.A.A.S. trials in the county, and small areas have been treated this season. Three rows of lettuce are planted to each run of cloches, which gives a total of approximately 16,000 lettuce per acre ($\frac{1}{2}$ acre covered). A gross return of 6*d.* per lettuce, which has been the average price for the last few years, gives a total return of £400 per acre for that crop.

Runner beans

Next in importance are runner beans, both pinched and staked. The labour requirement is high, particularly at harvesting time, but the returns can be most satisfactory. French beans have been tried and, although they need rather less in the way of labour, the yields are never so high. The beans are sown in mid-April and cloched until they touch the glass. After that they grow normally in the open. In this way a good yield is obtained early in the season when prices are at their best; an average of 1*s.* 6*d.* per lb is usually returned from Birmingham market. Rarely are any marketed after August Bank Holiday, since after that date prices normally slump.

Tomatoes

Tomatoes occupy an important place on the holding. The variety grown is Moneymaker and, after being started off under cloches, the plants spend most of their life outdoors. Plants are brought in from a reliable source and, although this costs some £80 a year, it is still considered to be more economical than raising plants on the holding, especially since the propagation period clashes with much other work. Planting is done in mid-May and, after removal of the cloches in the normal way, they are stood on end round the plants to keep off the cold winds. As soon as the weather becomes unfavourable in the autumn, the remaining fruit is removed to the glashouse where it is ripened. Three or four trusses are taken and these usually give a yield of some 5 lb per plant, which will return at least 6*d.* per lb. Although the labour requirement of tomatoes is very high, there is little doubt that at these levels of yield and prices they are a paying proposition.

Strawberries

Strawberries would be an excellent crop for cloches if they were easier to fit into the rotation. There is little doubt that if strawberries are grown then flower crops must be also, otherwise it will not be possible to occupy the cloches for the whole season. For example, anemones would be a suitable preceding crop (but they were unprofitable when grown at Ombersley!) with tomatoes to follow the strawberries. Even so, strawberries are grown each

year and show a good profit. Planting is always done as early as possible and the plants fruit only in their maiden year, after which they are discarded. Cloches are put on in February and picking starts in mid-May. There have been occasions when the strawberry crop has paid the total cost of new cloches in the first year, but more frequently the return is less spectacular. A reasonable return would be 5*s*. 6*d*. per lb from a yield of 2½ lb per yard run of cloches.

Flowers

Flower crops are not too popular at Ombersley, even though the best paying crop ever grown was a crop of sweet peas. This particular crop gave a gross yield of 30*s*. per foot run of cloches, but it needed so much labour for cutting and bunching that no other work was possible on the holding during the harvesting period. The sweet peas were sown *in situ* under the cloches in October, and in April the cloches were removed and the peas allowed to grow naturally; tall pea sticks were used as support. No attempt was made to follow the cordon principle, nor in Mr. Moule's view is it worth while.

Various crops are grown to a limited extent. For example, vegetable marrows are a good trade, provided they are really early. Early Brassica plants of various sorts can provide a useful income if they are grown on contract and the buyer is known before the seeds are sown. It is no use sowing this type of crop without such safeguards. Radishes are not grown as an early crop under cloches because of the amount of labour required for harvesting.

In a word—patience

There is no doubt that other crops and crop sequences can, and probably will, be thought up and tried out at Ombersley. But at present this holding is expanding by growing and marketing in an excellent manner those crops which are often condemned as uneconomic. If there is a secret of the success of the holding it can probably be summed up in the word "patience"—patience to consider the right crops and sequences, patience to grow at the right time and in the right way, patience to pack and grade properly, and above all patience to handle carefully each of 7,000 cloches many times each year and still lose only 3 per cent by breakages. In fact the answer to the question "Do Cloches Pay?" is probably summed up in that word.

The author wishes to thank Mr. Moule for his help and facility in the preparation of this article.

Vaccination against Brucellosis

E. C. Hulse

Free vaccination of calves with Strain 19 against brucellosis is available from 1st May

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BRUCELLOSIS (contagious abortion) of cattle is a disease characterized by infection of the uterus and foetal membranes which frequently leads to the death and premature birth of the calf. The responsible organism is *Brucella abortus;* a related germ causes Malta fever in man.

Brucellosis in cattle is almost world-wide. There are many countries in which the prevalence is between 10 and 30 per cent, depending upon the susceptibility of the local breeds, the degree of importation permitted and the control measures adopted. The infection rate within herds varies from one cow to all animals in a group exposed to infection. In this country the vaccination policy practised for the last twenty years has reduced the total abortion rate caused by brucellosis to less than one per cent.

The economic losses from the disease may be very considerable. Besides the likelihood of the calf being born dead or prematurely, the milk yield for that lactation may be greatly reduced; and there is further possible loss through infertility as a secondary consequence of abortion. Thus the planned milk production and breeding programme may be interfered with seriously.

Routes of infection

The usual source of infection in a clean herd is by the introduction of an infected female. The route of infection is frequently through the mouth and alimentary system and food, water and pastures contaminated by the foetus, membranes and uterine discharges of the infected animal readily serve as vehicles for the transmission of the disease. Dogs, foxes and vermin may carry the infective material about the countryside. Brucellosis may also be transmitted through the conjunctiva of the eye and through the broken or unbroken skin. The disease may also be found in the testicle of the bull and transmission may occur at natural mating or by artificial insemination, although this is probably an infrequent occurrence.

Calves are generally insusceptible to infection up to breeding age and, in herds in which the heifers are separated from the dairy cows until their first calving, infection usually does not occur until the second pregnancy. The disease may run a severe, acute course in a clean herd with an abortion rate of 50 per cent or more; this is known as an "abortion storm". Usually, however, the herd abortion rate is lower than this and it gradually diminishes

as the infection passes through the herd; the introduction of the first-calf heifers will, however, provide further susceptible stock and another peak of abortions will follow. An infected cow generally aborts once only, but abortions at subsequent pregnancies may occur. An infected cow may calve normally after having previously aborted, but the afterbirth and discharges are all heavily infected and the animal may remain as a "carrier" for a considerable period, even until the end of her life. Milk from infected cows, if consumed in the raw state, may cause undulent fever in man; farm workers and veterinary surgeons are particularly liable to the risk of infection from infective material present on the farm.

Diagnosis of the disease may be performed either by an examination of the blood serum by the agglutination test or a bacteriological examination of the aborted calf and afterbirth at a laboratory. A milk ring test on bulk milk samples is also made to screen out negative herds; this test is particularly valuable in saving labour and expense involved in the collection and examination of individual blood samples in the early stages of a control programme.

Way to control

Brucellosis cannot be controlled or cured by medicines or other therapeutic agents. Three control methods are available—either the removal of infected animals detected by the various diagnostic tests or by the vaccination of susceptible stock, or a combination of these methods. By the testing and removal method, all animals which are positive to the agglutination test are isolated and eventually removed from the herd. Additions to the herd are tested before admission and isolated in quarantine for two months until they have passed a second test; purchased pregnant animals are isolated until they have calved and after one month are tested before admission to the herd. This method is applicable in self-contained herds where the initial percentage of infected animals is low; the herd is, however, constantly susceptible to reinfection from outside sources. This method may be applied in conjunction with a vaccination policy, thereby ensuring adequate protection of the susceptible stock.

Vaccination is the control method of choice in this country and, indeed, in the majority of countries where brucellosis constitutes a major problem. Many types of vaccine have been used in the past but the most suitable is Strain 19, which originated in the United States. This vaccine, which has been in use in Britain since 1941, is a suspension of living organisms which are non-pathogenic for cattle; it confers a high degree of immunity on female stock which have been vaccinated as calves or before the first service. Large-scale experiments on calves at the Agricultural Research Council's Field Station at Compton, Berks, have shown that immunity conferred by a single dose of vaccine in calfhood endures at least until the fifth pregnancy or probably for the whole of the animals productive life. The vaccine generally induces a response to the agglutination test which may persist for a varying period; if calves are vaccinated at the optimum age (between the sixth and eighth month), the agglutinins will usually have disappeared by the time the animal reaches breeding age.

Preparing the vaccine

The usual period of preparing the vaccine is to grow the organisms on the surface of solid potato agar medium in glass flasks at 37°C and to harvest the

growth after 72 hours incubation. The vaccine suspension is tested for purity and for the presence of variants of the strain which might cause the vaccine to be less efficient as an immunizing agent. The vaccine concentrate is diluted so that a dose between 60 and 80 thousand million viable organisms is given to the calf by injection under the skin.

A recent development is the production of this vaccine in a liquid medium, and various techniques have been worked out in different countries. An apparatus evolved at the Microbiological Research Establishment at Porton has been adapted by workers at the Central Veterinary Laboratory, Weybridge, which enables the vaccine to be grown by a continuous flow method. A glass vessel containing several litres of liquid nutrient medium is seeded and continuously supplied with fresh medium while the bacterial growth and spent medium are removed at an equivalent rate. The medium is continuously agitated during the growth process and sterile air is bubbled into the culture vessel to provide an oxygen supply for the rapidly developing organisms. The foam produced by the air circulation is controlled by an anti-foaming agent which is added to the medium, and the acid-alkali balance is carefully controlled by electronic devices. The temperature of the vessel must be controlled throughout the operation and the harvested culture must be refrigerated to preserve its viability. Large quantities of vaccine suspension may be prepared by this method, which lends itself to a considerable degree of automatic control.

Freeze-dried vaccine

A further development in recent years is the preparation of the vaccine as a freeze-dried product. The bacterial cells in the liquid vaccine are in a fragile state, and temperature and other changes in the environment quickly kill them. Even in the cold store the "shelf-life" of liquid vaccine cannot be expected to extend beyond three months. The freeze-dried vaccine will retain its viability in the cold store for two years or more and at room temperature for several months. Freeze-dried vaccine has been used extensively in different parts of the world, particularly where the ambient temperatures are relatively high and the distances to transport the vaccine are great. The vaccine is now to be issued from Weybridge as a freeze-dried product.

The technique of drying the vaccine is similar to that used for drying plasma for the blood transfusion service. The liquid vaccine suspension, harvested either from growth on solid medium or in liquid culture, is distributed in the correct amounts in the vials in which it is to be issued to the veterinary surgeon in the field. The vials are frozen rapidly to less than -40°C and then subjected to a very high vacuum. As soon as the required degree of vacuum is obtained, heat is applied to the vaccine vials and the water content of the frozen vaccine is driven off as water vapour and condensed in the freeze-drying machine. Provided the frozen suspension does not melt during the process, the viability of the bacterial cells is retained and a very dry plug of living cells remains in the vial.

For use on the farm, this plug is reconstituted to its former liquid state by the addition of a suitable sterile re-suspending medium. The advantage of using freeze-dried vaccine is that it is considerably more stable under the varying conditions found in the field and that, in consequence, the veterinary surgeon using the vaccine can have confidence that the product will have retained its full immunizing properties. A vaccine which has lost most or all of its viability because of adverse conditions may well be of little value.

Free vaccination

On 1st May, 1962, Strain 19 vaccine will be issued by the Ministry free of charge for use in female calves aged between 151 and 240 days; the vaccination of animals older than this will be discouraged. Calves will be tattooed with an appropriate mark at the time of vaccination, so that they may be readily identified. The continued and wider use of vaccination of calves in this country should effectively reduce the incidence of a disease which has caused considerable economic loss to the farmer and become a hazard to public health.

Mr. E. C. Hulse, B.Sc., M.R.C.V.S., is a Senior Research Officer at the Ministry of Agriculture's Central Veterinary Laboratory, Weybridge. He has been in charge of the S.19 vaccine at Weybridge since 1942, and in 1952 was seconded to the World Health Organisation for 12 months as technical adviser on S.19.

The Ministry's Publications

Since the list published in the March, 1962, issue of *Agriculture* (p. 671), the following publications have been issued.

LEAFLETS

Up to six single copies of Advisory leaflets may be obtained free on application to the Ministry (Publications), Ruskin Avenue, Kew, Richmond, Surrey. Copies beyond this limit must be purchased from Government Bookshops, price 3d. each (by post 6d.).

ADVISORY LEAFLETS

No. 46. Docks and Sorrels (Revised)

No. 477. Chemical Weed Control in Onions and Leeks (Revised)

No. 478. Chemical Weed Control in Carrots, Parsnips and Parsley (Revised)

No. 510. Farming Restored Opencast Land (New)

MAJOR PUBLICATIONS

Copies are obtainable from Government Bookshops (addresses on p. 54), from any Divisional Office of the Ministry or through any bookseller at the price quoted.

BULLETINS

No. 55. Outdoor Salad Crops (Revised) 5*s.* (by post 5*s.* 5*d.*)
This completely revised edition deals with salad crops grown principally in the open, assisted where necessary by the use of glass. The choice of soils, cultivation, varieties, pests, diseases, harvesting and marketing are fully considered.

No. 182. Farm Sprayers and Their Use (New) 6*s.* (by post 6*s.* 5*d.*)
This new bulletin gives guidance to farmers on the basic problems involved in the purchase and operation of farm sprayers and on the use of weed-killers, insecticides and fungicides. It is a valuable aid to efficient crop protection.

OTHER PUBLICATIONS

Poultry Stock Improvement Plan (Regs. 1961/62)

48. East Surrey

L. M. Tighe

THE eastern area of Surrey consists of approximately 65,000 acres, covering one-third of the county and joining Kent to the east and Sussex to the south.

The climate is mild, not given greatly to extremes of heat or cold, and is, in places most enervating. Rainfall is around 25 inches per year on average, but recordings taken in the centre of the area during the past 10 years gave readings of 23 inches in 1953 and 40 inches in 1960.

Being immediately adjacent to London, much of the northern area has only slight agricultural significance but horticulturally it is still important. Despite building development, two-thirds of the 2,000 acres of horticultural land in the area is situated here, either under intensive market garden crops on River alluvium or on numerous smallholdings on the chalk.

Surrey is a county with many pleasant prospects, but the eastern area is not one of the prettiest. A large proportion to the north is built up, there are extensive lime quarries, sand pits and Fullers Earth workings in the centre, whilst to the south is the rather monotonous well-timbered weald in the middle of which is Gatwick Airport.

Geologically the area is interesting. To the north are the Chalk downs and Clay with Flints. East to west through the centre runs a narrow belt of Lower Greensand, bordered to the south by a large area of Weald clay into which overspills a small triangle of Tunbridge Wells sand from Kent and Sussex. The chalk and clay with flints are comparatively easy to work and capable of high production. The Lower Greensand in the centre is very highly farmed both agriculturally and horticulturally, whilst the Weald clay to the south, which comprises the greater part of the district, is typical dairying land. It is strong, difficult to work, and usually poorly drained, but it is capable of high yields, particularly of grass, if properly managed. The Tunbridge Wells sand has all the disadvantages of the weald and few of its advantages.

The area is equally interesting from an agricultural point of view. Dairying and livestock production are the main enterprises, certainly on the smaller farms, and whilst soil type governs the sort of farming practised, the proximity of ready markets influences the pattern to some extent. The large area of building development with its heavy population offers an almost inexhaustible outlet for eggs, poultry, cream, vegetables, etc. Sales of these commodities at the farm gate are almost guaranteed anywhere in the district, particularly if the grower is on one of the main roads and can provide a "lay-by" to allow customers' cars to get out of the traffic stream. This is a matter of some importance, because the busy A25 road crosses the district from west to east and the London to Brighton road from north to south.

While dairy cattle numbers have remained fairly constant at about 20,000, sheep have almost trebled in the last few years. This is rather surprising in view of the constant dog menace. Poultry have increased, but pig numbers, as usual, have fluctuated.

Surrey is often regarded as the home of the "hobby" farmer, and there are certainly quite a number in the eastern area. They are mostly successful business men who travel to town each day and concentrate on farming in the evenings, at week-ends and during vacations. The farm is usually under the control of a manager, and in most cases modern buildings have been put up, water supplies laid on to fields and attention given to drainage. In fact, everything possible is done to improve the property. These farmers usually prefer the breeding and rearing of high performance pedigree cattle and, not unnaturally, they are keen and enthusiastic in their application of modern techniques.

The backbone of the agricultural community is, however, formed by farmers of the more traditional type who are progressive and always seeking to improve. Also, there are a number of college-trained men farming on their own account who seem to be as familiar with a balance sheet as they are with a tractor or milking machine. It is rather unfortunate that the very high price of land in the area limits the numbers of this latter group, who are compelled to look for farms elsewhere in the country where prices are more in keeping with their limited resources.

Technically, much progress has been made in agriculture and modern methods have quickly been adopted. Examples of slatted floors, self-feeding of silage, paddock and zero grazing can all be found, whilst grassland recording has been practised for some years. It was in this area that the forage harvester was introduced to Britain.

Generally speaking, the trend is towards the yard-and-parlour system of cow keeping, but there are still many who prefer the individual attention which is possible in the more traditional type of cowshed, particularly since the introduction of pipeline milking and bulk collection.

As in many other predominantly dairying areas, the most popular breed seems to be the Friesian. Ayrshire and Channel Islands cattle are also very well represented and there are some outstanding examples of the breeds in both large and small herds. The number of pure beef herds is very small indeed and there are only isolated cases of single- or multiple-suckled herds. In keeping with the modern trend, the smaller dairy farmer frequently uses a beef bull on his heifers to produce colour-marked calves which are sold at a few days old. The minimum number of calves are reared for herd replacements so that as many milkers as possible can be kept on the restricted acreage.

The Clun sheep, both pure and with the various crosses with Suffolk and Down ram for fat lamb production, has gained great popularity. Scotch half-breds and Cheviots are also popular and there are a few flocks of Dorset Horns. In addition a considerable number of Kent sheep are taken in on agistment during the winter from the Romney Marsh, where they are returned the following spring.

Full advantage has been taken of both the Farm Improvement Scheme and the Silo Subsidy, and also of Drainage Grants, particularly on the Weald where drainage is of the utmost importance.

C. ROBINSON
Agricultural Land Service, London

Fire Risks in Farm Buildings

Of all the hazards to which our farms are exposed fire is perhaps the worst. Sudden and concentrated, all-consuming, its power grows. Its image is burnt into the mind of the beholder to come to life time and again and haunt the still watches of the night.

Though the devastation will vary with the intensity, there are usually far-reaching consequences. Even if the flames do not cause a building to collapse, the intense heat may destroy the nature of the masonry so that the remaining shell must be demolished. Steel frames may become distorted and steel sheets robbed of their protective covering or so changed in condition as to be worthless. Even asbestos sheeting can be destroyed, if not by the heat then by water played on it while hot causing fractures and even complete disintegration.

What the flames do not consume, smoke may ruin. Billowing through buildings not aflame, it impregnates everything it contacts so that hay and corn, meal and cake become unpalatable to stock and are ruined. And anything which escapes the flames and smoke may be spoiled by water, even though far from the seat of the fire.

With such a terrible prospect we ought to be much more fire-conscious than we are; much more ready to take precautions against such a catastrophe. And yet inflammable materials are still allowed to collect and remain in odd corners. Heaps of old hay and straw, sacks both jute and paper, old baler twine, and oily rags can be found in farmsteads, and it only needs a match or cigarette-end to start a fire the consequences of which can never be foretold; it may even end in death for the farmer or his workers or the firemen who come to fight it. And, horror of horrors, some still store vaporizing oil in buildings!

Figures for 1960 presented in a report entitled "United Kingdom Fire Statistics 1960" (obtainable from H.M. Stationery Office) show just how serious and widespread farm fires are.

These figures only refer to fires occurring in agricultural, forestry and fishery buildings and attended by local fire brigades. The total in England and Wales was 2,640, and the main causes were electric wire and cable (108), incubators and brooders (404), children with matches (424), naked lights (44), oil engines (44), tractors (40), rubbish burning (144), smoking materials (176) and 660 unknown sources.

There are obvious lessons to be learnt. Keep an eye on electrical wiring and resist the temptation to do a bit of wiring just because it looks simple. Pay careful attention to incubators and brooders, particularly when filling or adjusting oil burners. Keep children and matches well apart, and cart rubbish well away from buildings before burning it. Avoid smoking cigarettes and

tobacco in and around buildings. And in the 660 cases where the cause was unknown, what went wrong? Those fires didn't just happen, they were undoubtedly caused by carelessness or negligence.

To emphasize the figures still further, a comparison with those for other categories of buildings produces some unexpected results. Apart from those types of buildings much more numerous than farm buildings, such as dwellings, private sheds and garages, and offices, shops, hotels and catering establishments, all other buildings are less likely to catch fire than are our farmsteads. In fact, agricultural, forestry and fishery fires are exceeded by only six other categories.

The report includes a "league table" which lists 27 categories of buildings, and in twenty of them the incidence of fire is far less than in our category. These twenty categories include industries handling materials much more volatile than we have around our farmsteads, and having also greater concentrations of labour whose carelessness or negligence may start a fire. For instance, in the chemical and allied industries 508 fires were recorded; in textiles 684; in clothing 264; in timber and furniture 576; in paper, printing and publishing 296.

Confronted with facts like these, we ought to lose no time in removing anything which could help the spread of fire. We should also think about the means of fighting a fire if it starts.

Usually many miles from the nearest fire-station, frequently approached over narrow lanes or steep hills, and sometimes having no roads at all, our farmsteads stand unprepared and defenceless, a hostage to chance—chance that there will be no fire or that, when it comes, there will be no fog, ice, snow or other hazard to delay still more the progress of the fire brigade.

Nearly every fire starts in a small way. Few farms have water pipes large enough for fire hydrants, but they can still have some protection. A jet of water from even a 1-inch hose, given enough pressure, can douse a small fire or contain it until the brigade arrives. Strategically-placed chemical extinguishers can also be a great help. But they must be kept filled and in good order, not neglected so that they rust and deteriorate and are useless when needed.

Finally, however cautious we are we can never be proof against fire. The prudent landlord and farmer will, therefore, see that he is fully insured against fire losses. It's so easy to forget about insurance policies. Renewal dates seem to come round much too quickly, but, once paid, the premium brings a comfortable sense of security. Years pass, and often it is only after a fire that the inadequacy of the cover comes to light. Even if there have been no additions to a farmstead, cover which was decided upon five years ago is likely to be inadequate today; if ten years have elapsed then a fire could be a financial disaster. So, when the annual renewal date comes round the cover which the policy provides should be considered in the light of current building costs.

Fire insurance on buildings costs only a few shillings for each £100 of cover, so there can be no economy in under-insurance. And when new buildings are erected, or existing buildings improved, a re-appraisal of the insurance cover is essential.

Use of the Veterinary Needle

Reported by ***Sylvia Laverton***

In the twentieth century, many new vaccines, sera and other agents for the prevention and treatment of disease have been developed which are administered by means of the hypodermic needle. Reviewing the uses of the most common vaccines in a talk to the Farmers' Club on 14th March, Mr. A. G. Beynon, m.r.c.v.s., (Deputy Chief Veterinary Officer with the Ministry of Agriculture's Animal Health Division) emphasized that owners of stock would be well advised to make more use of vaccines which are readily available. "The veterinary surgeon should be brought in to investigate losses as early as possible", he said, "for only in this way can effective preventive measures, including vaccination, be successfully carried out. The future role of the veterinary surgeon will be directed towards herd disease control rather than on the individual animal".

The object of vaccination is to induce in the treated animal a reaction, sometimes a mild form of the disease, which stimulates the body to develop antibodies against the infective agent. The principle was first demonstrated by Edward Jenner, who showed in 1796 that inoculation with cowpox protects against smallpox. In 1881 Louis Pasteur demonstrated immunization against anthrax by injecting sheep with a weakened culture of the causal organism. His work led to a wide extension of immunizing methods against many diseases, with a corresponding widening in the meaning of the terms vaccination and vaccine. Against fowl cholera he used a vaccine made from the cholera organism grown in chicken broth and killed prior to injection. His anti-anthrax vaccine was made from live anthrax bacteria attenuated (made less virulent) by being grown in an unfavourable environment.

Active immunity, which can last months or years, may result from exposure to and recovery from a particular disease, or from vaccination, in which case immunity takes a little time to develop. Passive immunity, which lasts only 10–14 days, is obtained by transfer of the blood serum of an actively-immunized animal to one which is susceptible. Sometimes both serum and vaccine are given at the same time, so that by the time passive immunity has waned, active immunity has developed.

"It is important to realize that no vaccine is 100 per cent effective. Nevertheless, the various vaccines used in animals serve a real need and continue to be used because they give good, though not absolute, protection." The purity and safety of vaccines manufactured for sale or imported into Britain are governed by the Therapeutic Substances Order of 1952.

Vaccines and sera are especially valuable in the sheep industry, and today their use is a normal part of sheep husbandry. "Present methods of intensive grass production and selective breeding of animals for rapid growth make it necessary and increasingly worth while to apply these preventive measures",

said Mr. Beynon. Vaccines for more than one disease of sheep have been available for some time—e.g., for braxy and blackleg, and for lamb dysentry, pulpy kidney disease and tetanus. A recent preparation contains vaccines against seven clostridial diseases of sheep. After an initial injection, only one or two injections are needed annually to maintain a general level of protection.

Brucellosis, estimated to cause an annual loss of £2½ million in milk alone, and a total loss possibly amounting to £16½ million in England and Wales, also causes undulent fever in man. The incidence of the latter has declined greatly, since more than 90 per cent of our bulk milk is now heat treated. The Ministry of Agriculture's Calf Vaccination Scheme to control brucellosis by means of Strain 19 vaccine was introduced in 1944.

It has been shown that calves treated between their 151st and 240th day of life cease to react to the blood agglutination test by their first calving. Vaccination of adults is not encouraged, as it makes them life-long reactors to the blood test and so may mask infection. The systematic use of S.19 has markedly reduced abortion, but at present only about 400,000 calves are vaccinated annually. From 1st May, free calf vaccination with S.19 will be available under a new Ministry Scheme, for which some 1,400,000 calves are believed eligible. Vaccinated calves will be tattoo-marked, to diminish the demand for adult vaccination of bought-in stock, and so avoid prejudicing any future eradication scheme.

Against swine fever, inactivated crystal violet vaccine has been in general use since 1947. It gives satisfactory immunity to over 90 per cent of pigs properly vaccinated. Incidence of swine fever has dropped to 1,000–1,200 outbreaks a year. Piglets cannot be vaccinated until they are 3 weeks old, and treatment is not effective until 14 days later. These susceptible animals must therefore not be exposed to infection during this period. Adult animals in breeding herds should be re-vaccinated every 12 months. Otherwise, although apparently healthy, they may become infected and transmit the disease to their piglets.

A revised form of the Registered Vaccinated Herds Scheme is to be introduced this year designed to minimize these risks by more stringent conditions than those in the current scheme, dating from 1953. Isolation in suitable quarters for 28 days will be obligatory for purchased unvaccinated pigs, before vaccination and entry into the herd. Vaccination dates will be recorded and more attention paid to the health of pigs presented for vaccination.

Trials with a vaccine for Johne's Disease are in progress. For poultry, vaccines given in drinking water or by aerosol sprays seem likely to supersede injections here, as in America. Immunization against foot-and-mouth disease presents special problems, for 7 different viruses are known, 3 in Europe and South America, 3 in South Africa and 1 in Asia. Trivalent vaccines are available that protect against three virus strains, but with all foot-and-mouth vaccines there is a 14-day lag before satisfactory protection is established, and this usually persists only for 4–5 months.

Many countries use vaccination as a first step towards a slaughter policy. In Britain, vaccination is not deemed sound practice for a disease that is not endemic. It would cost over £2 million a year to vaccinate British cattle only once a year, and this would still leave 27 million sheep and over 5 million pigs unprotected, for as yet no satisfactory vaccine has been developed for these animals, nor for calves. Vaccination would be substantially more costly than slaughtering, which has averaged £824,000 a year in compensation to farmers over the past ten years.

Short Guide to the Annual Review, 1962

The results of the 1962 Annual Review and Determination of Guarantees were published in a White Paper (Cmnd. 1658)* on 15th March.

Agricultural net output continues to increase, and on the basis of the index introduced last year (1954 55 to 1956 57 = 100) is now forecast at 122 compared with revised figures of 119 for 1960 61 and 112 for 1959 60.

The wet weather in the autumn and winter of 1960 gave way to excellent spring sowing and planting conditions. Although the acreage of most crops was reduced, growth was generally good and yields satisfactory. On the other hand, the output of some horticultural crops, particularly top fruit, was low, though producers benefited from consequentially high prices. The output of livestock products generally, which accounts for nearly two-thirds of total agricultural output, has risen during the current year: fatstock, milk, eggs and poultry have all shown substantial increases. Tillage operations for next season's crops are well advanced.

The industry's net income for the year 1961 62 (ending 31st May) is forecast at £431½ million compared with a revised estimate for 1960 61 of £389½ million. Adjusted for normal weather conditions, the forecast for 1961 62 is £413½ million. This is £26½ million more than the revised estimate for last year of £387 million, which was itself a record figure.

Agriculture's costs have risen by a net amount for Review commodities of about £19½ million, due principally to increases in wages, rents and machinery expenses. On the other hand, the industry's efficiency continues to increase and a figure of £25 million can continue to be taken as an indication of the amount which, taking one year with another, the industry may expect to gain through increasing efficiency on Review commodities.

There has been a marked increase in the cost to the Exchequer of agricultural support. In 1960 61 it was £263 million. In 1961 62 it is expected to be £351 million. On the basis of no change in the guarantees, the estimated cost in 1962 63 is £339 million.

Changes in guaranteed prices are shown in Table 3 (p. 43).

SHEEP. The guaranteed price for fat sheep is reduced by 1*d.* a lb. in view of the significant increase in the breeding flock and the prospect of continuing low market prices and a heavy subsidy.

EGG production in the coming year is expected to be significantly higher than the present record level, which satisfies virtually the whole of the demand for shell eggs in this country. There is a real danger that production will exceed demand, and the guaranteed price is reduced by 1·5*d.* per dozen.

MILK. The guaranteed price for milk was increased last year by 0·8*d.* per gallon in the expectation that the industry would devise a payments system which would bring home to the individual producer that output beyond a certain level fetches only the manufacturing price, which is unremunerative and reduces the pool price. The industry has not, as yet, found an answer to the problem, and production has continued to increase. The guaranteed price is reduced by 0·4*d.* per gallon, and the effect of this, together with the continuing increase in output, is likely to be a reduction of about 1*d.* per gallon in the pool price which the farmer receives.

The retail price of milk will in future cover the full cost of the guarantee for the standard quantity. This change and other factors, including an increase in distributive costs, will mean that the retail price of milk will go up by ½*d.* a pint for six or seven months of the year.

In addition to these price changes, certain changes are made in the guarantee arrangements for some commodities. The minimum standards of eligibility for fat cattle are raised, and a new standard is introduced for lighter, young beasts of special conformation. To strengthen the pull of the market, the stabilizing limits which apply to the guaranteed prices for fat cattle and fat sheep are widened and the maximum weights on which the guarantees are paid are reduced.

SMALL FARMER SCHEME. The upper limit of the Scheme will be extended from 450 to 500 standard man-days, to give special help and encouragement to those small farmers who, because of their rather higher level of cropping and stocking, are at present outside the scope of the Scheme.

FERTILIZERS. Lower rates of subsidy for fertilizers will reduce the subsidy bill by an estimated £2½ million.

*H.M. Stationery Office. Price 1*s.* 6*d.* (1*s.* 9*d.* by post).

MARKETING RESEARCH. The Government has worked out with the Farmers' Unions a scheme of grants to encourage marketing research and development, and up to £1½ million will be made available for an experimental period of three years.

Under the Agriculture Act, 1957, the lower limit for the Government's determinations at the 1962 Annual Review was a reduction of about £14 million in the total value of the guarantees. The determinations made result in a reduction of just under £11 million.

Table 1

Estimated gross output of agriculture in the United Kingdom[1]
Years beginning 1st June

	£ *million*			£ *million*	
	1960 61	1961 62 forecast		1960 61	1961 62 forecast
TOTAL FARM CROPS[2]	270·5	276·4	TOTAL LIVESTOCK AND LIVESTOCK PRODUCTS	1,046·4	1,117·3
Grain:			Total fatstock	429·8	484·3
Wheat	74·9	61·6	Cattle	195·7	227·1
Barley	67·9	76·0	Calves	5·3	5·6
Oats	10·2	9·9	Sheep and lambs	78·5	88·7
Other	0·4	0·4	Pigs	150·2	163·0
Potatoes	64·5	82·5	Milk and milk products	352·6	364·8
Sugar beet	39·4	32·6	Eggs[3]	170·9	169·3
Hops	7·2	6·8	Poultry[4]	74·4	79·1
Other	6·1	6·6	Wool	16·1	17·1
TOTAL FRUIT, VEGETABLES AND FLOWERS	139·8	164·3	Other	2·6	2·6
Fruit	37·0	52·0	CHANGE IN STOCKS[6]	+ 8·7	+ 18·1
Vegetables	78·1	85·8	TOTAL	1,502·8	1,610·5
Flowers and nursery stock	24·7	26·6			
OTHER OUTPUT[5]	37·3	34·4			

1. In Great Britain from holdings of over one acre only; in Northern Ireland one acre and over.
2. Includes sales of crops for feed.
3. For food and for hatching.
4. For food and for stock.
5. Includes deficiency payments for barley, oats and mixed corn not sold off farms.
6. Value at market prices of changes in the volume of stocks and work in progress.

NOTE. Because of rounding, sums of constituent items do not always coincide with totals as shown.

Table 2

Estimated farming net income in the United Kingdom
Years beginning 1st June

	£ *million*			£ *million*	
	1960 61	1961 62 forecast		1960 61	1961 62 forecast
FARMING NET INCOME	389·5	431·5			
TOTAL EXPENDITURE	1,263	1,269	TOTAL REVENUE[5]	1,652·5	1,753
Labour	300·5	299·5	Farm crops[5]	270·5	276
Rent and interest	105·5	117	Fatstock	430	484·5
Machinery:			Milk and milk products	352·5	365
Depreciation[1]	80	83	Eggs and poultry	245·5	248·5
Fuel and oil	46·5	49	Horticultural products	140	164·5
Other	88	92	Other products	55·5	53·5
Feedingstuffs[2]	351·5	376	Production grants and other credits	119	119
Fertilizers	111	114·5	Valuation change[6]	39·5	42
Seeds[3]	32	30·5			
Imported livestock[4]	53	62·5			
Other expenses	95	45			

1. Estimated provision for machinery and vehicles, at replacement cost.
2. Gross value of bought feed whether home-grown or imported.
3. Imported seeds plus merchants' margins on home-grown seeds.
4. Imported livestock plus transporting and merchanting charges on inter-farm sales of home-bred livestock.
5. Estimates in Table 1 are here adjusted for changes in stocks awaiting sale. Includes receipts from sales of crops for feed.
6. Increase in value at cost of stocks and work in progress.

Guaranteed Prices

Table 3

CROPS (*a*)

Commodity	(i) Guaranteed Prices for 1961 harvest determined after the Annual Review, 1961	(ii) Price change compared with the 1961 Annual Review Guarantee	(iii) Guaranteed Prices for 1962 harvest determined after the Annual Review, 1962
Wheat (per cwt)	26*s.* 11*d*	No change	26*s.* 11*d.*
Barley (per cwt)	27*s.* 7*d.* (*d*)	No change	27*s.* 7*d.* (*d*)
Oats (per cwt)	27*s.* 5*d.*	No change	27*s.* 5*d.*
Rye (per cwt)	21*s.* 7*d.*	No change	21*s.* 7*d.*
Potatoes (per ton)	265*s.* 0*d.*	No change	265*s.* 0*d.*
Sugar Beet (per ton, 16·5 per cent sugar content)	128*s.* 0*d.*	No change	128*s.* 0*d.*

LIVESTOCK AND LIVESTOCK PRODUCTS (*a*)

Commodity	(i) Guaranteed Prices 1961/62 determined after the Annual Review, 1961	(ii) Price change compared with the 1961 Annual Review Guarantee	(iii) Guaranteed Prices 1962/63 determined after the Annual Review, 1962
Fat Cattle (per live cwt)	167*s.* 0*d.*	No change	167*s.* 0*d.*
Fat Sheep and Lambs (per lb estimated dressed carcass weight)	3*s.* 3*d.*	— 1*d.*	3*s.* 2*d.*
Fat Pigs (per score deadweight)	43*s.* 7*d.* (*b*) related to a feed price of 24*s.* 7*d.* per cwt. On the basis of the current feed price of 27*s.* 9*d.* per cwt this guaranteed price is equivalent to 46*s.* 9*d.*	No change	46*s.* 9*d.* (*b*) related to a feed price of 27*s.* 9*d.* per cwt.
Eggs—hen (per dozen)	3*s.* 8·63*d.* (*c*) related to a feed price of 23*s.* 5*d.* per cwt. On the basis of the current feed price of 26*s.* 7*d.* per cwt this guaranteed price is equivalent to 3*s.* 11·29*d.*	— 1·5*d.*	3*s.* 9·79*d.* (*c*) related to a feed price of 26*s.* 7*d.* per cwt.
Eggs—duck (per dozen)	2*s.* 3·06*d.* (*c*) related to a feed price of 23*s.* 5*d.* per cwt. On the basis of the current feed price of 26*s.* 7*d.* per cwt this guaranteed price is equivalent to 2*s.* 5·72*d.*	No change	2*s.* 5·72*d.* (*c*) related to a feed price of 26*s.* 7*d.* per cwt.
Wool (per lb)	4*s.* 5·25*d.*	No change	4*s.* 5·25*d.*
Milk (average per gallon)	3*s.* 2·25*d.*	— 0·4*d.*	3*s.* 1·85*d.*

NOTES ON PRICE TABLES

(*a*) The guaranteed prices for fat cattle, fat sheep and wheat are average prices subject to variation seasonally; the guarantee payments for fat cattle and some fat pigs are subject to variation according to quality; and the method of calculating fatstock guarantee payments involves an element of estimation. Because the marketings of fatstock and wheat cannot be accurately forecast, producers' average returns under the guarantees for those products in any year may be a little more or less than the guaranteed prices.

(*b*) The guaranteed price for pigs is subject to the flexible guarantee arrangement introduced in 1961/62.

(*c*) The prices guaranteed to the British Egg Marketing Board for hen and duck eggs are subject to profit and loss sharing arrangements in accordance with the terms of a financial agreement between the Government and the Board. They include an allowance for the Board's administrative costs in operating the guarantee arrangements and marketing expenses (including packers' margins, packaging costs, transport and, in the case of hen eggs, certain trading losses).

(*d*) The guaranteed price for barley is subject to arrangements whereby, to encourage a more even spread of marketings over the season, the deficiency payments are adjusted so that growers receive a higher rate of acreage payment for barley delivered, after sale, in the later months of the cereal year than for barley delivered in the early months of the year.

The Major Agricultural Shows this Year

BATH AND WEST AND SOUTHERN COUNTIES	
TAUNTON	May 30–June 2
THREE COUNTIES	
MALVERN	June 12–14
ROYAL COUNTIES	
PETWORTH	June 20–23
ROYAL SHOW	
NEWCASTLE-UPON-TYNE	July 3–6
GREAT YORKSHIRE	
HARROGATE	July 10–12
ROYAL WELSH	
WREXHAM, DENBS.	July 24–26
ROYAL DAIRY SHOW	
LONDON	October 23–26
ROYAL SMITHFIELD	
LONDON	December 3–7

CORRECTION

Agricultural Chemicals Approval Scheme (*February, 1962, issue, p. 617*).
Under Herbicides — Dichlorprop Liquid Formulations —
"Shepp DP" should read "Shell DP".

Agricultural Chemicals Approval Scheme

Additions to the 1962 List of Approved Products

THE following additional products have been approved under the Agricultural Chemicals Approval Scheme. The Second List of Approved Products was published on 1st February, 1962.

INSECTICIDES

ENDOSULFAN—*Liquid Formulations*
Thiodan—Murphy Chemical Co. Ltd.

'KELTHANE'—*Liquid Formulations*
'Kelthane' 20—Murphy Chemical Co. Ltd.

FUNGICIDE

DINOCAP—*Wettable Powders*
Crotothane—May & Baker Ltd.
Crotothane—Plant Protection Ltd.

MANEB—*Wettable Powders*
Murphy Maneb—Murphy Chemical Co. Ltd.

NABAM—*Powder Formulations*
Dithane A-40—Pan Britannica Industries Ltd.

ORGANO-MERCURY COMPOUNDS—*Foliage Sprays*
Phelam—Murphy Chemical Co. Ltd.

ZINC-ACTIVATED P.E.T.D.
A zineb-polyethylene thiuram disulphide complex for the control of potato and tomato blight.

Wettable Powders
Boots Potato Blight Spray—Boots Pure Drug Co. Ltd.

HERBICIDES

DICHLORPROP—*Liquid Formulations*
Hormatox—Baywood Chemicals Ltd.

DINOSEB—(DNBP)—*Amine Salt Formulations*
Farmon DNBP (Amine)—Farm Protection Ltd.

DINOSEB FORMULATIONS IN OIL
Products specifically formulated for the destruction of potato haulm and simultaneous control of certain weeds in the crop.
Atlas Emulsifiable DNBP Potato Haulm Killer—Atlas Preservative Co. Ltd.
Marks DNBP Haulm Killer—A. H. Marks & Co. Ltd.

ENDOTHAL *with* PROPHAM
A residual herbicide mixture for use pre-emergence in sugar beet, to control many germinating annual weeds.

Liquid Formulations
Murbetex—Murphy Chemical Co. Ltd.

MECOPROP—*Potassium and Sodium Salt Formulations*
Farmon P—Farm Protection Ltd.
Fletcher's Mecoprop CMPP 32—Sam Fletcher Ltd.

IN BRIEF

Rearing Pullets on Oats

Pullets reared at Trawscoed E.H.F. on whole white oats and grass have shown a saving in food during the rearing period, and they have laid more eggs of a larger size than pullets reared on a balanced meal ration.

This experiment, conducted over the years 1955-59, throws an interesting light on the theory held by some poultry farmers that rearing pullets should be fed a ration high in fibre.

From the age of eight weeks, Rhode Island Red pullet chicks were reared on free range. The pullets were then split into two equal groups at random and placed in two separate paddocks. One group was reared on a balanced ration. In 1955, 1956 and 1957 this ration was a proprietary rearing pellet. In 1958 and 1959 the ration was a meal of known constituents. The second group was reared on whole white oats. Both groups were fed *ad lib.* At the point-of-lay stage 126 pullets, selected at random from each group, were placed in a McBain hen battery. During the laying period both groups of pullets received the same layers ration on an *ad lib.* basis. In 1955, 1956 and 1957, the ration was proprietary, whilst in 1958 and 1959 it was of known constituents.

During the growing period the oat-fed pullets consumed on average 3 oz of oats per day. The daily consumption of the meal-fed pullets was higher at 4·7 oz. Taking the average production over the five years, the oat-fed pullets have layed 1½ dozen more eggs per bird per year than the pullets reared on a balanced meal.

Charollais Bulls: Allocation and Trials

The 27 Charollais bulls released from quarantine at the end of January have been individually allocated to artificial insemination interests in England and Wales: 17 to the Milk Marketing Board; 3 to the Ministry's Artificial Insemination Centre at Reading; 2 each to Artificial Insemination centres at Lyndhurst (Hampshire), Ilminster (Somerset) and Bromsgrove (Worcestershire); and 1 to the Isle of Man Board of Agriculture.

Two bulls which were lame were moved from quarantine to the hospital of the Royal Veterinary College for detailed examination but have now been released, one to the Milk Marketing Board and the other to the Ministry.

The remaining 25 were allocated by lot, the draw being made by Professor H. G. Sanders, Chief Scientific Adviser (Agriculture) of the Ministry of Agriculture, who is Chairman of the Working Group which organized the trials with the Charollais bulls. This Group includes representatives of the cattle industry and A. I. centres as well as officers of the N.A.A.S.

These trials are designed to test the suitability of the breed as a crossing bull for production of beef from the dairy herd, in comparison with British beef breeds. The Charollais trials are being organized in three parts.

For the Group A trials, two Ministry Experimental Husbandry Farms and three other centres, where individual feeding facilities are available, will be comparing the Charollais with Herefords in crosses on Friesians and Ayrshires and also with pure Friesians, for liveweight gain and efficiency of conversion, and on assessment of the carcasses.

Nearly 40 centres which lack individual feeding facilities but are otherwise able to maintain accurate records will be participating in the Class B trials, and will compare the Charollais with 12 different crosses of British beef breeds on dairy breeds and also with pure Friesians.

The Milk Marketing Board will be responsible for the third group of trials, which will be in the nature of a survey of farmer's experiences with Charollais. Farmers who participate will be asked to record information on such matters as calving difficulties and on age and weight at slaughter. These farmers will, of course, rear the Charollais crosses according to their own ideas and resources.

Shading of Glasshouses

Shading of glasshouses is not as beneficial as is often thought. The main advantage is the reduction in daytime temperature, but the lowering of light intensity may be a positive disadvantage. A number of centres have been looking into this, notably the Lee Valley Experimental Horticulture Station, the Agricultural Research Institute at Kinsealy, Eire; and in Israel.

At each of these centres tomatoes have been the experimental crop, and in each case yields have been reduced where shade was used. At the Lee Valley Station the results suggest that the adverse effect on yield is related to the length of time the glass is shaded and the degree of light restriction. The table below shows in detail the effects recorded at Lee Valley; it will be seen that both of the shaded crops gave lower monetary returns as well as lower yields. So the reduction in yield arising from the shade was not compensated by an improvement in fruit quality. It will also be seen that the weight of rough and unmarketable fruit was higher in the shaded than in the unshaded plants in three instances out of four.

Yield and gross monetary return per 84 plants

Treatment	*For period 6th June—31st July*			*For whole crop*			
	lb	£	Rough and waste *lb*	*lb*	£	Rough and waste *lb*	Tons per acre
SHADE (applied 12th May)	426	29	45	778	43	77	55
NO SHADE	542	37	36	873	50	85	62
SHADE (applied 10th June)	503	28	95	855	42	193	60
NO SHADE	524	32	68	916	48	116	65

Variety: Ware Cross. Sown 7th Feb., 1961; planted 4th April. A minimum night temperature of 62°F wa maintained and marketing of the crop began on 6th June.

In the face of these results it may be wondered whether the shading of glasshouses should be practised in any circumstances. Growers can often reduce the need to shade by giving more ventilation, and it may be unnecessary if the fruit is well protected from direct sunlight by the foliage. But tomatoes are liable to fruit-ripening defects such as "yellow-back" and "green-back" which are caused by excessive temperature, and localized overheating of the fruit can occur from direct sunlight, even with full ventilation. Therefore in exceptionally hot weather light shading of 1 lb whitening paste in 1 gallon water and 1 gallon buttermilk can be applied to any parts of the tomato houses especially exposed to sunlight—the southern ends for example. There is less need to shade if varieties resistant to "yellow-back" are grown—e.g., Moneymaker, Eurocross or the varieties possessing resistance

which are being developed at the Glasshouse Crops Research Institute at Littlehampton, Sussex.

In-store Cooling of Bulk Grain

In the interests of speed, grain drying machinery is sometimes used with inadequate cooling, so that often the grain is still warm when put into store. This can give rise to serious infestations, particularly by the saw-toothed grain beetle. The Pest Infestation Research Board* has been looking into the possibilities of in-store cooling of bulk grain which can prevent the rapid development of insects and allow some reduction in the amount of cooling in the drier,so that the output of the drier may be stepped up. If cooled thoroughly during storage, the grain may be stored safely at a slightly higher moisture content than is permissible for warm grain, thus giving further economy during drying. But it is important to remember that any reduction in the amount of drying must be undertaken very cautiously, since during in-store aeration the amount of cooling and the distribution of moisture vary in different positions in the bulk. The dampest grain may be in the warmest positions.

In-store cooling has been used extensively in the chief grain-growing area of the U.S.A. to prevent damage, during the severe winters, due to movement of moisture from the warm interior to the cold surfaces of grain bulks. Such cooling can be done readily there in the autumn when the sudden fall in temperature makes for safe cooling with cold, dry air. In Britain the problem is different, for it is important to cool the grain as soon as possible after harvest; in addition, the damp and moderate winter temperatures make in-store cooling more hazardous.

Hence the Board's research with barley in an East Anglian malt factory and in a laboratory pilot experiment. From the first-mentioned it is reported that a hot bulk of grain can be cooled during September to the temperature (about 18 C/65 F), below which the saw-toothed grain beetle cannot develop. This is done by blowing air through perforated pipes laid along the floor of the grain store. Lower temperatures may be necessary to prevent trouble by other insects (e.g., grain weevil) and by mites.

**Pest Infestation Research 1960*. Agricultural Research Council. H.M. Stationery Office. Price 6*s*.

Field Gates and Posts

British Standard 3470:1962 specifies design and construction requirements for wooden field gates 9 ft to 12 ft wide, and for gates of steel, both tubular and angle frame, 10 ft, 11 ft, 12 ft and 14 ft wide. Requirements are given for fittings and for posts of wood, concrete and steel, both tubular and rolled.

It is recognized that there are steel gates which may still be of sound construction even though the dimensions of their members are less than, and their design departs from, the requirements laid down; for such gates tests are specified, and if these are passed the gates are deemed to comply with the standard. This is an important point.

This standard is most welcome. The number of field gates on the market is legion and there must surely be some that are not good. It is to be hoped that, in future, farmers and other buyers will make sure that the gates they select comply with B.S. 3470:1962, copies of which are obtainable from British Standards Institution, British Standards House, 2 Park Street, London, W.1, price 7*s*. 6*d*.

Books

Weed Control: As a Science. G. C. KLINGMAN. John Wiley and Sons. 68*s*.

Designed for United States students of modern weed control technology this is a readable and concise book, which fulfils its intention admirably. Some of the terms used are at variance with accepted British usage but there is little that is likely to confuse the reader. Each chapter is concluded by a list of references for those who wish to study any aspect more thoroughly.

The first seven chapters are of greatest value to British students. They describe clearly the problem of weeds, the place of cultivation and herbicides, and the factors affecting herbicides such as weather, soil, the condition and stage of growth of weeds and crop, the formulation of herbicides and the inclusion of surface active agents in sprays. The spraying machine is discussed, and the student is even introduced to such problems as "galvanic corrosion". It is interesting to read that, although losses due to weeds in the U.S.A. are three times greater than those caused by insect pests, considerably more time and money is spent on research on insects.

Several chapters dealing with groups of herbicides and their molecular structure are less satisfactory for the British student, as they omit some of our more important herbicides and do not discuss others in terms of customary British usage.

The final part includes the use of cultivations and herbicides for particular crops or particular weed problems such as woody weeds, aquatic weeds and weeds on industrial land. It is not always clear how reliable some herbicide treatments are because both established and experimental uses are discussed.

The author deals with many crops not grown in Britain and rather sketchily with those that are. The section on cereals ("small grains"), for example, gives no indication of the complicated situation to be found in this country; some statements are not in line with official British recommendations. All this limits considerably the value of the later chapters to the British student, but nevertheless the book is well worth reading.

S.A.E.

Farm Organisation and Management (Second edition). GORDON HAYES. Crosby Lockwood. 25*s*.

In his first chapter the author draws a clear distinction between policy-making and its subsequent execution, between farm organisation and management. The book comprises four main sections. Part I is concerned with the institutional background against which the farmer must make his decisions—agricultural legislation, marketing arrangements and prices, an elementary introduction to the law of supply and demand being given to illustrate certain features of agricultural prices.

Part II deals with the factors which must be taken into account when deciding on the policy for a farm — soil and climate, location for markets, availability of land, labour, machinery and capital, the experience, the personal preferences and attitude to risk of the farmer. Economic theory is again introduced by showing the application of the law of diminishing returns. It is restricted, however, to the problem of finding the optimum level of yield, and not extended to the policy problem of finding the most profitable combination of enterprises.

Land, labour and capital are each discussed, and particular consideration is given to assessing both total and seasonal requirements. The sources of capital available to the farmer are set out in detail.

In Part III the organizational and management problems of the main farm enterprises are dealt with: crops, milk, beef, sheep, pigs and poultry. Costs of production are given for various products, but their presentation is not consistent and there is an occasional lapse into the enterprise full cost account statement, which can be so unhelpful in farm management.

Part IV deals with the measuring of farm efficiency and farm planning. Account analysis is used for the total farm and for component enterprises using comparisons with farm type groups. Following this the technique of partial planning (or budgeting) is shown as a method for assessing the financial outcome of changes in policy or

operation suggested from the previous business analysis. And finally the methods used in full farm planning are illustrated in a detailed example.

Although the opportunity has been taken in this second edition to bring the data up to date, it must be regretted that some of the recent developments in farm management techniques, such as the gross profit approach and programme planning, have not been introduced into what is otherwise a comprehensive coverage of the subject.

I.G.R.

Roosevelt's Farmer: Claude R. Wickard in the New Deal. DEAN ALBERTSON. Columbia University Press. 48*s*.

Claude Wickard was borne in 1893 on an Indiana farm. After taking his degree he returned to manage the family farm. Interest in local affairs and the Democratic Party platform led him, first, to a regional appointment in the U.S. Department of Agriculture and then to Washington D.C. in 1940 as Under Secretary of the same Department. Later in that year he was appointed to the chief (and Cabinet) post of Secretary, a position he retained throughout the war years until the Truman administration came in 1945.

This interesting and well-written book is mostly about Wickard's official life in Washington. Food surpluses, so we read, are no recent feature of U.S. agricultural policy. Except for a few of the war years, the eternal problem was how to maintain a fair and reasonable farm income in the face of continually rising farm output. Many legislative tactics are described.

In the war years, when the brakes on production were removed, commodity prices had to be controlled if rampant inflation was to be avoided. We, in Britain, should be grateful to Wickard. He recognized early the importance of food in a global war, and to press for more production when existing supplies seemed abundant was far-sighted and courageous.

Wickard's position was never an easy one. His difficulties were not diminished by his awe of a magnetic President; he was never entirely comfortable with him. There were intense frictions inside the Department itself, quite apart from those facing any Secretary of Agriculture from Congress and the various pressure groups with which Washington abounds.

These are the daily burdens of most Secretaries, but they seem to have been more intense in Wickard's case. It appears that he knew what he wanted to do, but encountered unusual difficulties in implementing his policies. Memoranda may outline a policy, but it requires an able and devoted staff to operate it. The author is critical of Wickard's management of the human equation.

H.E.

Crop Spraying Simplified. MICHAEL BRADFORD. Blackwell Scientific Publications. 9*s*. 6*d*.

During the past fifteen years the combine harvester and the selective weed-killer have revolutionized British farming. Fifteen years ago spraying machines were a rarity: today the low-volume sprayer is standard farm equipment. Manufacturers of spray chemicals have kept pace, and today we are approaching the stage of having sprays for almost every weed in almost every crop. With new chemicals being introduced every year, the average farmer must find it very difficult to remember which is which and what each is for.

Periodically the British Weed Control Council issues the *Weed Control Handbook*, which gives technical details of all the new weed-killers and their uses. Mr. Bradford, who is a member of a well-known firm of agricultural merchants, has rewritten the *Weed Control Handbook*. He has cut out the complicated chemical formulae and replaced them with common chemical names and trade names. He has explained in simple language what each chemical is, what it does and how and when it is used. Chapters have been added on the sprays used against insect pests and fungus diseases. There are also chapters on the adjustment, care and maintenance of spraying machinery.

Mr. Bradford emphasizes that the best insurance the farmer has of the reliability of a chemical is to use only those products which are registered under the Ministry of Agriculture's Approval Scheme. The reader is generally not confused with the rates at which they are used, as it is felt that these are best obtained from the labels on approved products.

The busy farmer who does not want to be bothered with too much technical detail will find this book very helpful in keeping him up to date with the practical use of the latest chemicals. Where he has a particularly difficult weed problem, it will help him to choose the best spray for the job.

G.C.P.

The Fat of the Land. JOHN SEYMOUR. Faber and Faber. 18*s*.

If you are interested in the possibility of enjoying a hard life, with no mod-cons and off the beaten track, have a look at *The Fat of the Land* by John Seymour. The author, having tried a variety of occupations and travelled to many countries, finds himself a wife, and they set out to live on a boat. He is a writer and a broadcaster, and all goes well until children come on the scene. The boat is laid up and they come ashore to settle in a remote part of Suffolk, overlooking the coastal marshes. Their new home with its five acres of derelict land needs a great deal of toil and sweat, and they make a start on a "do-it-yourself" living. The theme of this account of how a family lives is not new, but the author deals honestly with the situation.

The complications and misfortunes in learning the arts of gardening, cropping and rearing livestock, even on a small scale of a few acres, were learned the hard way. For them it was a series of adventures, but they taught themselves to be as self-supporting as possible. The author admits that his living was a financial necessity but this was the life which he and his wife wanted.

To those who may be attracted to leave the modern tempo behind them, this book will help them to decide just how much of this life they might learn to enjoy. One certain good piece of advice is that husband and wife should share a common philosophy. Much credit goes to Sally Seymour who prefers making cheese rather than money. Besides caring for children and discharging the many chores of living, she helps the purse as a potter. She has also found time to illustrate this book with some charming drawings of the home scene; in particular, I like the cider cask with the gum boots below to catch the drips!

P.J.O.T.

Chrysanthemums the Year Round. 2nd Edition (Revised). SYDNEY A. SEARLE and BARRIE J. MACHIN. Blandford Press. 30*s*.

Five years have passed since the publication of the first edition of this book and during that period the chrysanthemum has become even more popular with the grower and the scientist. The experiences of one and the experiments of the other have so widened our knowledge of this crop that it is difficult to keep pace with developments. The second edition of this book is as comprehensive as the first, and it gives everyone interested in chrysanthemums a unique opportunity of becoming up to date. The increased number of references, one of which is dated 1962, gives some indication of the thoroughness of the revision.

The keen person who wishes to inquire into reason and effect will find many of the answers here, and the grower who wants to know "how" will be equally satisfied with part two, which deals with year-round production. A vast amount of information is given on equipment, technique and varieties, but the section on natural season production is a little less authoritative; early-flowering chrysanthemums are dealt with in only two pages. The major pests and diseases, and their control are well covered. The authors emphasize the importance of "clean" stock and give an insight into the methods used by specialist propagators. In fact, the science and practice of chrysanthemum growing is covered from beginning to end but marketing, the final link in the chain, is barely mentioned.

There seems little doubt that the production of this flower is becoming more a science and less an art, and the authors are to be congratulated on the orderly layout and systematic presentation of facts. Much of the background information is equally valuable for crops other than chrysanthemums and any glasshouse grower, adviser or student, would find it difficult to invest thirty shillings more wisely.

A.R.C.

Horticultural Research, Vol. I, No. 1. Edited by C. A. WOOD and W. W. FLETCHER. Oliver & Boyd. 15*s*.

Any new publication making available the results of experiments must be welcome. Too often information remains unpublished or only appears in print long after the experiments were completed. In these days of rapid change and progress in the horticultural industry it is most important that results should be quickly available.

The editors and publishers are to be complimented on this first number although, as pointed out in the Editorial, in order to keep to a time-table they have had to rely in this issue mainly on papers contributed from one centre, The Scottish Horticultural Research Institute. To ensure a wide appeal, future numbers must, I feel, show a greater variety.

It is pleasing to note that the Editors have adopted a recommended layout which all papers submitted should follow.

Three papers on raspberries will be of outstanding interest to both growers and research workers, as showing how a balance

has been achieved between the more practical growers' problems and recent developments in investigations into virus problems.

In the report on variety trials with Brussels sprouts, I didn't like the way of presenting variety yields. To get a clear picture of performance, the grower will want to know not only yields as percentages of a standard but also the yields in cwt/acre of the standard. Reference is made to internal browning of the sprouts, a problem becoming of increasing importance with the demand from processors for quick freezing, but apart from the fact that there appears to be variety susceptibility and that internal browning occurs in apparently marketable sprouts, little fresh light is thrown on this problem. There appears to be a pressing need here for further research.

S.P.C.

Handbuch der Tierzuchtung. 1961. (In German.) (Second Half of Volume 3: The Breeds.) Edited by J. HAMMOND, I. JOHANSSON and F. HARING. P. Parey (Hamburg and Berlin).

In this half-volume the editors have carried their monumental conception through to its logical conclusion. The first 163 pages deal with pig breeds and the next 140 with breeds of sheep. There are eight pig chapters, including one on British pigs by H. R. Davidson, of Harpenden, and one on the same breeds in Australia by L. A. Downey. Overseas the most popular breeds of British origin appear to be the Large White, the Berkshire (Germany and Hungary) and the Tamworth (U.S.A.). In general, however, each State appears to have a wide variety of indigenous or "manufactured" breeds.

Progeny testing in W. Europe and the U.S.A. is discussed, and there is a long introductory chapter by Haring. The introductory chapter to the sheep section is by Dr. H. Schäfer. British sheep are dealt with in more detail than those of any other country by A. M. Leroy. H. B. Carter writes on the Merino and there is a chapter on the fur breeds by J. F. Langley. Breeds of goats are dismissed briefly in 19 pages. Less than 50 pages cover poultry breeds; the chapter by M. Pease on the Cambridge "autosexing" breeds is outstanding here. Goose, duck and turkey breeds receive proportionately more attention. The chapter on animals of the fur farm devotes most space to the fox and mink, mentioning also martens, otter, badger (rather surprisingly), skunk, coypu and chinchilla. The final chapter deals with ten breeds of rabbits, rather arbitrarily selected. The quality of the terminal chapters appears rather uneven, but the main part of the half-volume worthily sustains the high standard which the earlier volumes have set.

F.L.M.D.

The Nutrition of the Young Pig. (Tech. Comm. 22). I. A. M. LUCAS and G. A. LODGE. Commonwealth Bureau of Animal Nutrition. 25*s*.

The gathering momentum of research in all fields of agriculture necessitates the preparation of frequent reviews, and the authors have produced a book which will be a valuable addition to the existing literature on pig nutrition. They have collected information on the nutrition of the young pig from its birth to 45 lb live weight in respect both of pigs weaned early (Part I) and of suckled pigs (Part II). They emphasize, however, that no reference is made to work reported after June 1960, and that their conclusions should not be accepted without the consultation of more recent contributions.

It is perhaps significant that whereas 78 pages are devoted to Part I, Part II comprises only 20 pages. This ratio reflects the preoccupation of research workers with the nutrition of the early weaned pig and the relative lack of information concerning the young pig under natural conditions, still the predominant concern of most pig producers. However, from their comprehensive review of data accumulated from many countries concerning digestion, diet and specific nutrients, the authors have been able to present a useful summary of the early weaned pig's requirements and thus to recommend allowances. The facts have been expressed in a uniform and systematic way, the methods used being clearly set out in a preamble and exemplified in an appendix. Part I also refers to the effect of early weaning on the performance of pigs to bacon weight, on their health and on the sow.

Part II is restricted to work on the growth and development of the sucking pig, the supply and composition of sow's milk, the requirement for supplementary feed and the use of antibiotics. There is a short section on creep feeding in practice.

The authors are to be congratulated on having welded a mass of information, often conflicting, into a logically developed treatise, which will become a standard work of reference for all concerned with pig nutrition. *T.G.B.*

Four Farms. FARMERS WEEKLY. 5*s*.

Grove Farm, which *The Farmers Weekly* has been developing and writing about, week by week, ever since 1943, is one of the best-known farms in the country, though most farmers would find it difficult to say exactly where it is. It is, in fact, near Tring, in Hertfordshire. On its 200 acres it carries a milking herd of 70 Ayrshires, with about 70 cross bred followers; these cattle require 140 acres of grassland, thus leaving 60 for corn.

"Our first purpose," says *The Farmers Weekly* in this brief but succinct account of its farming ventures, "was to share at first hand the problems and fortunes of the ordinary farmers—to get some of our own mud on our own boots."

At the end of the first decade it was realized that the industry's worst problems were being piled on the shoulders of farmers with units smaller than the 270 acres which Grove Farm then comprised. So, with considerable courage, *The Farmers Weekly* sliced 70 acres off the top end of Grove Farm and set about turning it into a separate unit. By the time the building programme was finished, Bulbourne, as it was called, had cost more than £300 an acre which, even by the latest auction standards, seems prohibitive. Yet the accurately presented accounts show that the expenditure was justified, for Bulbourne makes a useful annual profit, though, for a number of reasons (one of the most important of which was the cut in milk prices) the net figure fell from £1,422 in 1959/60 to £527 in 1960/61.

In the summer of 1959 *The Farmers Weekly* stuck its neck out yet again. Appreciating that the small hill farm was floundering deep in the economic blizzard, it bought a 75-acre marginal farm, Broadley, in the Black Mountains of South Wales. There was almost every conceivable handicap: bad access, inconvenient buildings, lack of drainage, overgrown hedges, bracken infestation, mineral deficiencies of the soil, steep slopes, an antiquated house and heavy rainfall. The usual thorough budget indicates that in 1962 the venture should begin to show a trading profit.

Finally, *The Farmers Weekly* has recently become tenant of the 1,164 acres of moorland near Hexham known as Cowbyers Farm, where it hopes to become familiar with the problems of fell farming.

The paper has done a great service to farmers by showing how a bold and intelligent use of capital, with proper planning, can create viable farming enterprises from what many of us would regard as hopeless material. *R.W.*

A Bibliography of Farm Buildings Research 1945-1958 Part VII, Miscellaneous Items. Agricultural Research Council. 2*s*.

Brought up in less sophisticated days when the bran tub was a feature of the village fete, I experienced just the same tingle of delight when I dipped into this, the seventh and final part of this Bibliography. Nor was I disappointed, for this slim volume contains just as many surprises as the bran tubs I remember.

Inevitably, in preparing a bibliography on such a complex subject as farm buildings, there was bound to be a collection of material which did not fit into a specific group and yet could not be ignored. This chapter of miscellaneous information ranges over buildings for particular purpurposes, such as sheep, tractor fuel and manure, and it also touches on building materials. In addition, it deals with surveys of farm buildings and farm buildings development, studies design, construction and equipment of farm buildings and includes economic studies such as the capital and annual cost of farm buildings. The economic studies have been done on the Continent, and it is just a little startling that we in this country seem to have done nothing about this highly important aspect of buildings.

Finally, under the heading "Various" we find information on accidents in farm buildings, the simplification of farmstead work and the possible use of heat pumps in farmsteads.

No bran tub ever contained such value for money, and this final chapter is the equal of its forerunners in excellence and usefulness.

Although chapters can be purchased separately, the total cost of the Bibliography is only 22*s*. 6*d*., plus postage, and there is no one book on farm buildings which offers such value at this price. It is strongly recommended to all who have any interest in farm buildings. It is, I understand, to be kept under constant revision by the Agricultural Research Council.

C.R.

Research Techniques in use at The Grassland Research Institute, Hurley. BULLETIN No. 45, Commonwealth Bureau of Pastures and Field Crops. 40*s*.

This book is the result of many enquiries made for details of the techniques, experimental methods, apparatus and equipment used at the G.R.I. It does not claim to describe the only, or even the best, techniques available, but simply those which, after two decades of trial and error, have been found to be satisfactory. This is a modest claim, but the book, as well as being very useful for reference purposes, might well serve as a standard from which other techniques in this field may be developed, and by which they may be judged.

Although techniques and apparatus are forever changing and developing, the greater part of this book is unlikely to be outdated for many years to come. The descriptions are not limited to the Institute: other workers are quoted where appropriate, and the list of 127 references allows the reader who so wishes to look up further details.

The approach is very much towards the field rather then the laboratory. Specialized chemical techniques are deliberately excluded, though adequate details are given of common laboratory processes. In Part I, there are chapters on the general principles of experimental design and on the problems and principles of grassland experimentation, ranging from pot experiments to small-plot and field-scale experimentation with and without the grazing animal. Further details of design and method are given in Parts II—V on Herbage, Animal, Plant-Soil and Extension Trial work. Part VI describes special laboratory equipment and its use. The whole is well illustrated. There is no index, but the book is adequately sub-titled for easy reference.

Perhaps its main virtue is that it neatly summarizes within one slim volume the major features of almost every technique in the range of Grassland Research: it should therefore be equally useful as a standard reference for workers in research, extension and education. *D.S.M.*

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